TELEPHONE ENGINEER

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MANAGEMENT • ENGINEERING • MAINTENANCE

MARCH 1937

Cover Illustration
RAISING LINES BEFORE INUNDATION BY FLOOD WATERS

▼ ▼ ▼

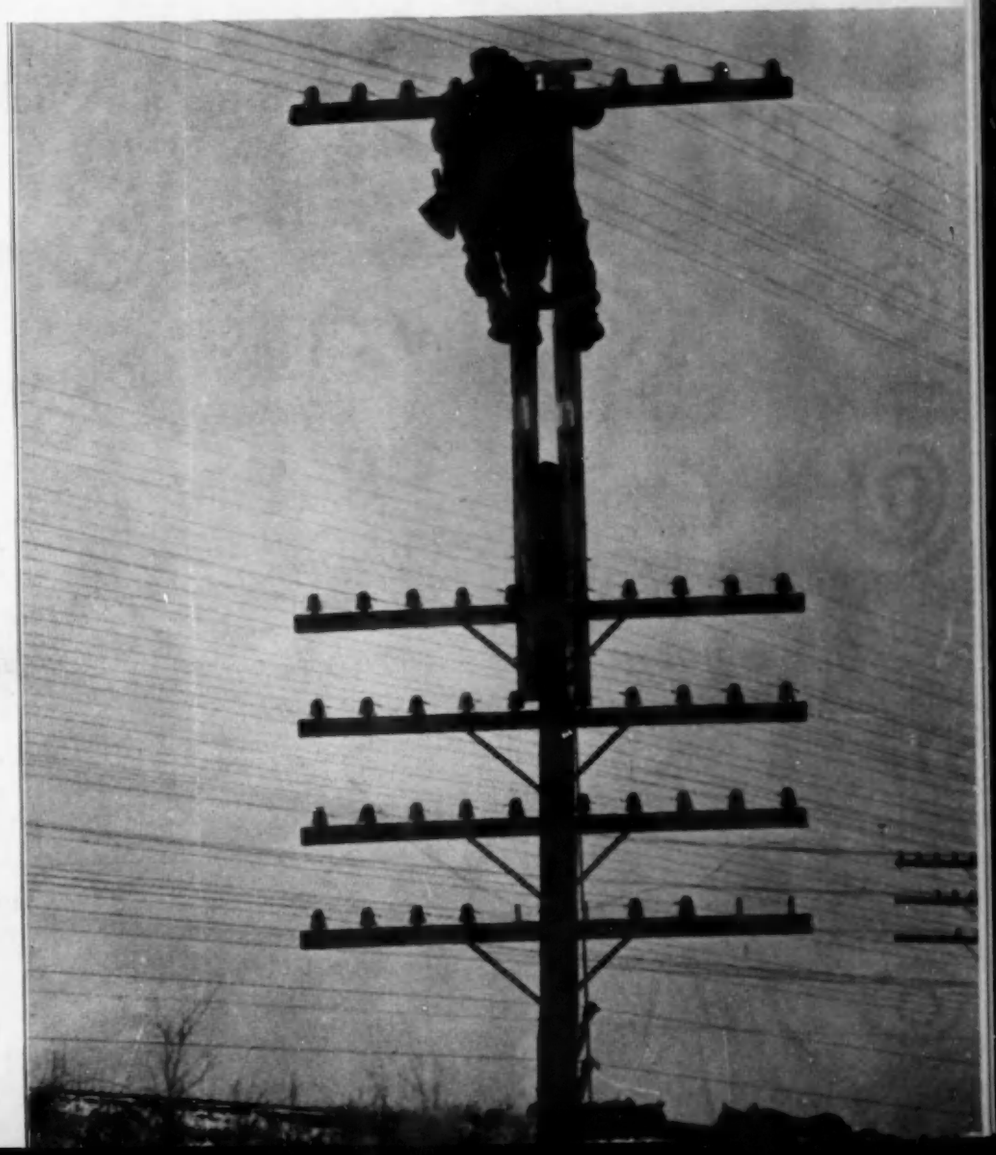
NORTHERN WHITE CEDAR
By Don C. Bell

▼ ▼ ▼

TELEPHONE TRANSMISSION THEORY AND PRACTICE
Chapter XIV
Robert A. Clark, Jr.

▼ ▼ ▼

SWITCHBOARD MAINTENANCE
Part IX
C. K. Brown



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IN THIS ISSUE

"Tapping In" On Washington . . Roland C. Davies 13

Remagnetizer for Ringer Magnets . O. H. Danielson 15

Telephone Transmission—Theory and Practice Chapter XIV . . . . . Robert A. Clark, Jr. 17

Switchboard Maintenance—Part IX . . C. K. Brown 20

Modernization Program of Public Telephone Corp. . . William J. Scheidler 28

Line and Desk . . . . . Ray Blain 30

Monthly Telephone Station Barometer 32

A Short History of Northern White Cedar . Don C. Bell 34

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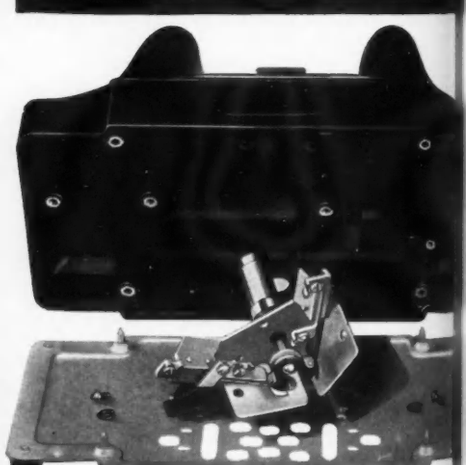
16. RESONANCE CHAMBER AND NEW TYPE GONGS—GREATER CONCENTRATION AND PENETRATION OF RINGING TONE.
17. *TRIAD* CIRCUIT WHICH ELIMINATES SIDE TONE AND DISTORTION WITHOUT SACRIFICING VOLUME.

Capsule type receiver. Cobalt steel magnets . . . Bronze contact clips replace bothersome cord terminals.



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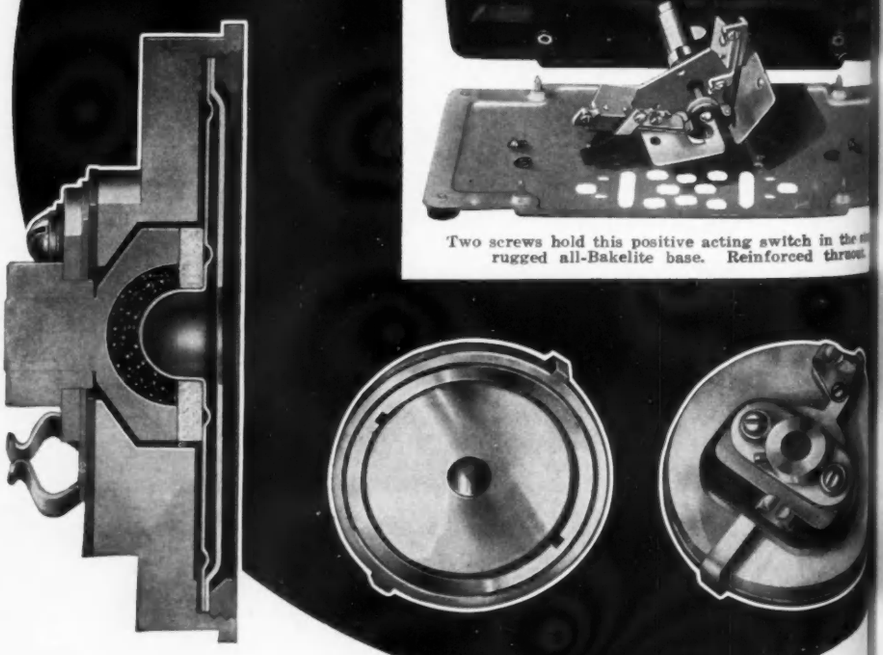

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Editorial « « «

An editorial urging telephone companies to support their state associations ordinarily has little news value to engineers and maintenance men. To the management announcements of dates for the various state association meetings are usually treated by the majority as "run of the mill" news. To the editor it is usually the same story told year after year with the ultimate goal of getting rid of the chore the easiest way.

But for 1937 — we have something to write about — and you have something to hear. So important has become such subjects as *Rural Electrification, Social Security, Unemployment Insurance, New Taxes* already in effect, *New Taxes* now under advisement by local, state and national governments, and *New Laws* already enacted or about to be enacted which vitally effect the telephone industry, that the management, their engineers and maintenance men must discuss these matters as quickly as possible and as thoroughly as possible.

So this year the state associations will be well attended. Their services will be more appreciated. This is illustrated clearly by the Minnesota and Nebraska meetings. Your associations can help your POCKET BOOK—and for this service they are going to have one of the best years of their existence. We feel we will not have to urge and plead with you to support your various associations this year; they are now CARRYING THEIR OWN WEIGHT and you as a telephone man will be the loser if you fail to support and attend their conventions.

Doing a real job year in and year out—prepared by well organized plans to fight your battles as they come up—these different associations have literally forced every thinking man in the industry to support them not only by the small nominal dues necessary to help carry on their work, but by assisting to combat problems that they as your watchdogs have discovered.

Then as a member of the association you will be helping the industry and also protecting your pockets from scheming politicians working for themselves but not their country. We thank You!

TELEPHONE ENGINEER
MANAGEMENT • ENGINEERING • MAINTENANCE

MARCH, 1937

"Tapping In" On Washington

FCC Seeking Additional Duties . . .

By ROLAND C. DAVIES
Editor
Telecommunications Reports

● As the FCC Telephone Investigation now will be on its last lap of public hearings during the next two months, the telephone industry can focus its attention upon a new branch of activity which has arisen out of that inquiry at the Communications Commission—the Telephone Rate and Research department. This new department of the FCC is designed to continue the studies, launched during the investigation, and to evolve for the Commission a broad program of telephone regulation, not only on interstate rates but also in connection with activities and practices of the telephone operating and manufacturing industry.

The outstanding development of recent weeks in the FCC activities was the sudden resignation of Samuel Becker, youthful New Deal lawyer of the so-called Felix Frankfurter school, from the special counselship of the Telephone Investigation. Becker submitted his resignation to President Roosevelt with the view that he wished to return to private law practice in his native state of Wisconsin. His retirement, although it had been rumored for many months, came because he had completed his role in the investigation—the direction of the legal prosecution of the general accounting and policy subjects of the inquiry, while the remaining subjects to come up in the investigation hearing will be on engineering and manufacturing studies over which he has had no supervision.

● The new Telephone Rate and Research department, which will carry on the work of the investigation until July 1, 1938, is being organized by Carl I. Wheat, FCC Telephone Rate Counsel, who, it will be recalled, was the leading figure in the consummation of the negotiations between the Commission and the American Telephone and Telegraph Co. resulting in the annual $12,000,000 long distance rate reduction. Wheat, who will be in charge of the new department, came to the Federal Comission with a wide experience and reputation in utility regulation as counsel of the California Railroad Commission and of the city of Los Angeles. The new department will have the duties of analyzing and examining the results of the investigation hearings and exhibits to formulate for the Commission definite and concrete conclusions and policies to aid in its future regulation of the telephone industry and rates.

On the program of work for the new department are four main objectives—first, the rates and operating practices of the A.T. & T. Long Lines department; second, the interstate rates and practices of the Associated Bell and other connecting telephone companies; third, general regulatory problems affecting the interstate rate situations and fourth, development of information and material for use by state commissions in their rate investigations. Among outstanding studies facing the new department will be "license contract" practices in the Bell System, Western Electric price policies, accounting and valuation problems especially those relative to depreciation, state commission rate proceedings, and relations between the A.T. & T. and Associated Bell companies in regard to interstate rates.

● The new department of the investigation is being planned to work in close co-operation with the Commission's regular staff with the fundamental goal of trying to develop the entire factual and practical background of the technical rate problem, while active and continuous liaison will be maintained with the companies on all rate matters so rate realignments can be secured through the conference or negotiation method without the resort to protracted and controversial hearing procedure. Through the new department it is also contemplated the FCC will become a "clearing house" of information on telephone regulation not only for its own activities but also for the state commissions.

Future Program of Investigation Hearings . . .

● The hearing schedule in the Telephone Investigation with the practical completion of the accounting and general subjects, which have been presented under the prosecution of the resigned Special Counsel Becker, contains about 15 reports on engineering and manufacturing studies that remain to be presented by Cyrus G. Hill, Investigation chief engineer, and his staff. With the exception of a report on the patents of the Bell System, which is to be presented at a March 22 hearing, no Investigation hearings are slated by the FCC until about mid-April. Then several series of hearings will be staged under the direction of Telephone Division Chairman Paul A. Walker and his two Division associates, Vice Chairman Thad H. Brown and Commission Chairman Anning S. Prall, until the end of May.

In the meantime, the Telephone Division is now engaged in the preparation of a report to be submitted to this session of Congress on the results of the Investigation. However, it is expected that the bulk of the Investigation reports will be prepared the coming summer and fall for submission to the next session of Congress, which will convene in January, 1938. It is also expected that the Commission will not transmit its major legislative recommendations, based on the Investigation results, until the next Congress.

● President Roosevelt and Telephone Division Chairman Walker in accepting the resignation of Special Counsel Becker paid tribute to his efforts in the handling of the Investigation. Writing "Dear Sam", the President stated that Becker's work had been a hard job in digging into the intricate transactions of big business. The President cryptically wrote that Becker was standing by on home leave only and should be ready to return to the firing line. Whether that will mean the youngish Wisconsin attorney, former counsel of Governor Philip LaFollette, will be returned to the FCC work was not indicated nor have any such rumors occurred in Washington.

In the conducting of the Investigation, Becker tried to emulate the methods of Ferdinand Pecora, now New York state supreme court justice, when the latter quizzed J. P. Morgan and other leaders of the financial world before the Senate committee in 1933. Becker shot a barrage of questions at each witness and for a greater part of the proceedings demanded categorical answers to involved or hypothetical questions without any explanations. No cross-examination was allowed of Commission witnesses by the A.T. & T. counsel nor was the telephone company given any opportunity to put any rebuttal testimony in the record. In its 1936 annual report, the A.T. & T. succintly summed up the Investigation status by stating that the hearings thus far had been "one-sided" and the company had had no opportunity to present its side. Becker, too, through excerpts of letters and memoranda and through his method of examination presented at the outset of the Investigation hearings in the spring of 1936 a number of would-be sensational disclosures with a possible objective of stirring up favorable newspaper publicity. However, the resigned special counsel had "tough breaks" with each sensational story—his disclosures had to compete in the news columns with floods, the Simpson affair, the Hauptmann execution and the national conventions.

CONVENTION SCHEDULE

Texas Telephone Association, Baker Hotel, Dallas, March 16, 17, and 18.

Oklahoma Telephone Association, Huckins Hotel, Oklahoma City, March 23 and 24.

Iowa Independent Telephone Association, Hotel Fort Des Moines, Des Moines, April 6, 7, and 8.

Wisconsin Locally Owned Telephone Group, Park Hotel, Madison, April 13.

Wisconsin State Telephone Association, Park Hotel, Madison, April 13, 14 and 15.

Ohio Independent Telephone Association, Deshler - Wallick Hotel, Columbus, April 21 and 22.

Indiana Telephone Association, Claypool Hotel, Indianapolis, May 11 and 12.

Pennsylvania State Telephone and Traffic Association, Harris Hotel, Harrisburg, May 20, 21 and 22.

Missouri Telephone Association, Muehlbach Hotel, Kansas City, May 25 and 26.

The Illinois Telephone Association, Hotel Pere Marquette, Peoria, September 22 and 23.

FRONT COVER

Elevation of wires before the flood is not dramatic unless one analyzes the snow storm the men are working in or the levee shown at the bottom of the picture. These intrepid linemen were successful in their endeavor to overcome devastation of their line by the extension upward as shown. A view of the next ten poles would show the same work being done by the large crew that handled this job. It was finished before the water over flowed.

Communications Has Little Interest for Congress . . .

● Radio broadcasting apparently will occupy the center of the stage in Congress at this session as far as the functions of the Federal Communications Commission are under scrutiny on Capitol Hill. There appears to be little interest in any legislation regarding the telephone industry among the leaders of Congress.

● The broadcasting chains and the FCC supervision over broadcasting may become a subject of a House Investigation, although there seems no definite indication of the approval of such a move. However, Rep. Connery (Democrat, Massachusetts) has proposed such a probe and certain House leaders have given a sanction at present to his program. But more important subjects like the Supreme Court revamping and the Governmental Reorganization program may shunt aside any less important legislative moves like a broadcasting inquiry. The Congressional study of the Governmental Reorganization which would dismember the FCC and would place it under the jurisdiction of the Commerce Department has been slow to get under way. Only the Senate-House committee has been organized and no hearings have yet been held. When hearings are staged, it is quite likely that strenuous opposition will arise to the President's plan, particularly about the dissolution of the Independent commissions, like the Interstate Commerce Commission, Communications Commission etc.

● The only bill of interest to the telephone industry, which has been introduced, is the renewed proposal for the banning of telephone free service, except as dictated by the Commission. The bill, which was sponsored by Chairman Lea of the House Interstate Commerce Committee and is identical to the measure proposed by the FCC un-

(Please turn to page 41)

By O. H. DANIELSON

Remagnetizer for Ringer Magnets

Mr. Danielson of Bell Laboratories discusses and illustrates their recent development for simplication of remagnetization.

THE audible signal which notifies a telephone subscriber of an incoming call is produced by a "ringer." This is an electric bell in which the clapper, as it vibrates, strikes alternately a pair of gongs. The clapper is driven by the armature of a double coil electromagnet. The armature itself and the cores of the electromagnets are biased by an associated permanent magnet. The ringer is operated by a low-frequency alternating current and the magnet coils are wound so that this current alternately strengthens the pull of one core on the armature and then that of the other. This makes the armature vibrate and rings the bells. To prevent the armature from operating from other currents it is mechanically loaded in one direction by a biasing spring. For satisfactory operation the strength of the permanent magnet must be maintained above a definite limiting value.

In the manufacture of ringers the permanent magnet is magnetized after the assembly. As a result, however, of later handling and particularly of demagnetizing influences encountered during service it sometimes happens that the strength of the permanent magnet is reduced sufficiently to impair the operation of the ringer. In the past it has been necessary to return the subscriber set to the nearest shop when remagnetization is needed.

● Recently a simple demagnetizer was devised which was operated by dry cells and could be used on ringer magnets without removing the ringers from subscriber sets. The experimental use of this device resulted in such general improvement in the capabilities of ringers that the development of a similar tool was undertaken by the Laboratories for use in Telephone Company storerooms and on the subscribers' premises. It was anticipated that such a tool would reduce ringer maintenance costs and would result in a general improvement

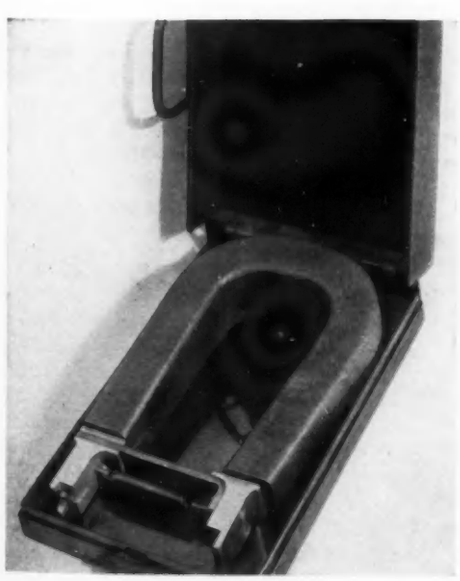


Fig. 2. The sheet steel carrying case also serves as a keeper for the magnet and as a magnetic shield.

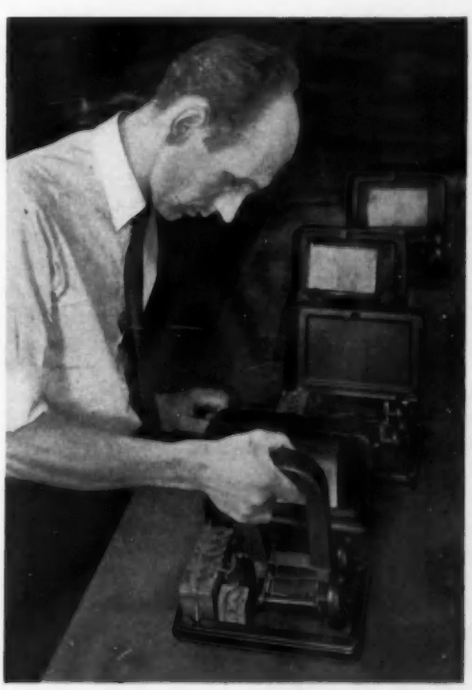


Fig. 1. The remagnetizer can be used on ringers assembled in the subscriber sets housed in metal and phenol plastic boxes.

in the quality of ringers. Early in the development it was suggested by I. C. Pettit that a device using a cobalt steel magnet would accomplish the desired degree of remagnetization with a possible saving in weight and the elimination of direct current.

The remagnetizer as constructed (coded the No. 481A Tool) consists essentially of a "U" shaped permanent magnet of cast cobalt steel and a pole-piece assembly which are illustrated in Figure 2. The Pole-piece assembly comprises two soft steel pole-pieces designed to fit on the ends of the ringer magnet and a forked-shape phosphor bronze tie bar which is permanently fastened to one of the pole-pieces. The forked portion of the tie bar slides in grooves in the sides of the other pole-piece and the pole-pieces are drawn toward each other by means of a helical spring. This self-adjusting feature insures a snug overlapping as well as butting contact between the pole-pieces and the ends of the ringer magnet. As generally used the pole- piece assembly is fastened permanently to the cobalt steel magnet by means of a screw which passes through one pole-piece and is threaded into one of the pole-faces of the permanent magnet. A single application of the device to a ringer magnet is all that is required to accomplish remagnetization.

● Another arrangement of the tool involves applying the pole-piece assembly to the ringer magnet before the magnetizing magnet is brought into contact with the pole-piece. This facilitates the use of the remagnetizer on ringers in inaccessible locations. With this arrangement the screw which ordinarily fastens the pole-piece assembly to the magnetizing magnet is replaced by a threaded dowel pin. This serves to locate the magnet properly and to prevent it from being accidentally reversed with consequent changes of the ringer's polarity. The pole-piece assembly is first fitted to the ringer magnet, after which the magnetizing magnet is applied.

A sheet steel carrying case, which also acts as a keeper for the magnet as well as a magnetic shield, is provided for the tool. The accumulation of magnetic materials on the magnet and the accidental magnetization of watches when the tool is not in use is thus avoided. The total weight of the tool and the carrying case is about 7½ lbs. of which the magnet accounts for approximately 4¾ lbs.

This tool has been tried out by all of the associated telephone companies with results which have been so promising that it has now been made available for general use.

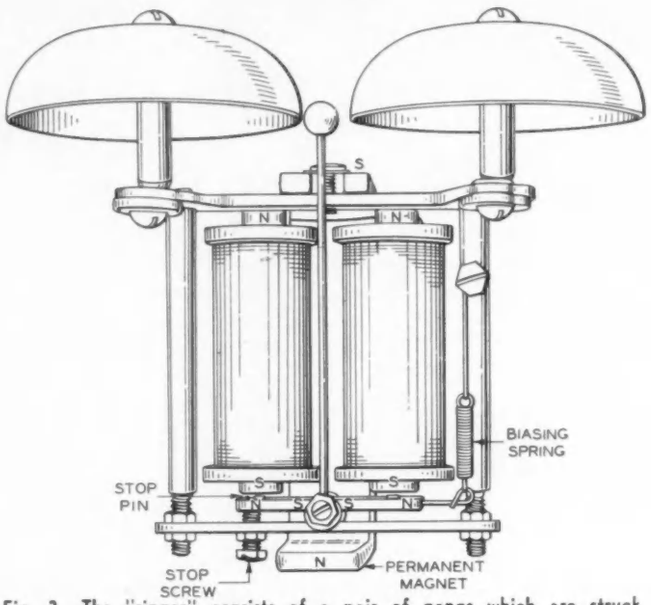


Fig. 3. The "ringer" consists of a pair of gongs which are struck alternately by a clapper attached to the armature of a double coil electromagnet. The armature and cores of this electromagnet are biased by a permanent magnet and a spring and stop keeps the bells from being rung by unwanted currents.

Court Decision Favors Jamestown Telephone Co.

Deciding in favor of the Jamestown (N. Y.) Telephone Company who contested the action brought by the New York Telephone Company for payment of alleged toll divisions amounting to $206,270 under its former toll contract, the judiciary of the New York Supreme Court directed the jury to bring a verdict of "no cause for action" on February 18. The decision is interpreted that the New York Telephone Company could not sue on a former contract with the Jamestown company but could only bring action on a basis of "quantam mercuit" or a showing of proper compensation for services.

Principal witness for the successful defendant was John H. Wright, president of the company. His testimony regarding the cancellation of the former contract his company had with the plaintiff took many hours. The contract had been cancelled by action of the board of directors of the Jamestown company. The court held that the letter of Charles T. Russell, general counsel of the plaintiff, after this action by the board and a few days before termination of the contract, urging continuation of toll service arrangements until a new contract was arranged, was the same as acceptance to the ending of present contract and acquiesence for a new arrangement. Controversies between opposing counsel as to admissability of certain pieces of testimony, documents and papers filled a large portion of the proceedings. Attorneys for the plaintiff took exceptions to the directed verdict for any appeal action.

Mrs. Dillon Dies

Mrs. Susan Boyd Dillon, 53, wife of W. C. Dillon, long time telephone man and head of the Dillon Manufacturing Company, died February 25, following an operation in a Chicago hospital.

Pallbearers were the six sons who survive, beside Mr. Dillon and eight grandchildren. Burial and services were held in Chicago.

Bell Sells Vandalia (Mo.) Interests

The Vandalia (Mo.) Union Telephone Company has purchased the interests of the Bell Telephone Company there and will begin at once to combine the two systems. Vandalia has had two telephone systems for the past 25 years.

The Vandalia Union Telephone Company plans to make improvements and rebuild the system on a common battery system. They have been granted permission to borrow $10,000 to make the contemplated improvements.

Telephone Transmission

Theory and Practice

By ROBERT A. CLARK, JR.

CHAPTER XIV

The Principles of carrier current telegraphy and telephony are discussed in this chapter. A brief history of the development is presented.

● We now come to one of the most interesting phases of long distance telegraphy and telephony, i. e. the use of carrier currents to convey the signals. You are all familiar in a general way with the principles of radio broadcasting and the theory of operation. Carrier current telephony and telegraphy are similar to radio except that wires are used to transmit the electrical energy rather then sending it through space. The term **carrier current** is derived from the method of transmission; the signals, either telegraph or telephone, are carried over the wires by means of an alternating current of frequency several times that of the signals being transmitted. Let us illustrate this by the electric lighting system in your home. Most of you are supplied with light by means of the alternating current system at 60 cycle frequency. When you turn on a switch, current flows through the filament and it lights up. If a telegraph key was inserted in place of the light switch you could send telegraph signals which would be visible to the eye by the glowing of the lamp fila-

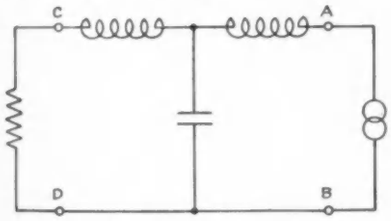


Fig. 70. Low pass filter section.

ment. Or if an a-c relay was connected in place of the lamp which, in turn closed a contact through a local sounder and battery circuit we could have a telegraph system similar to the standard Morse circuit discussed in Chapter VIII and shown in Fig. 39. The telegraph signals are said to be carried by means of the alternating current.

You have all noticed flickering of your lamps at some time or other which may be due to one of many causes. When the lamp flickers the voltage applied to it varies momentarily. In our carrier current theory such fluctuation in voltage is known as **modulation**. By modulating a relatively high frequency with one of lower frequency we obtain a resultant high frequency alternating current which will carry the low frequency component over a pair of wires without interfering with other similar low frequency components also carried over the wires. In effect this means that by use of carrier frequency energy we can transmit a number of telegraph or telephone channels over one pair of wires simultaneously and without any interference between them.

Theoretically, there is almost no limit to the number of telephone or telegraph circuits which could be obtained by means of carrier current operation over one pair of wires. Practically, however, at this time we can obtain on one pair of wires either one or two d-c telegraph circuits, one voice frequency telephone circuit and either about five carrier duplex or single line telegraph circuits or two carrier telephone circuits. If a combination of telegraph and telephone circuits are required, two or three duplex carrier telegraph circuits and one carrier telephone circuit can be obtained. This is due to limitations of the ordinary open wire telephone line such as affected by transpositions and entrance cables. The greater the number of derived circuits either telephone or telegraph, the higher the frequency band to be transmitted over the wires. Each telephone circuit requires a group of frequencies about 6,000 cycles in width. In order to transmit two carrier telephone circuits we therefore require a transmission band extending up to about 18,000 cycles. This is about the maximum frequency that can be transmitted over open wire lines without resorting to special modi-

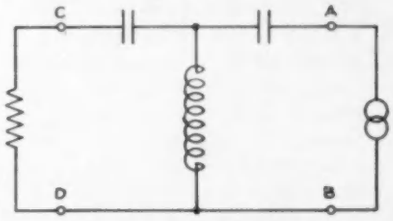


Fig. 71. High pass filter section.

fications of the line such as low loss insulators and special transpositions.

● The history of carrier current communication dates back to about 1886 when Elisha Gray derived the theory of carrier current operation and built a multiplex telegraph system using vibrators and tuned reeds to provide the selective signaling. The same principle is followed today except that we use vacuum tubes to generate the alternating current instead of mechanical vibrators and electric filter circuits to separate the signals at the receiving end. Professor Gray set up his carrier telegraph system on wires of the Postal Telegraph-Cable Company between New York and Chicago, and according to historical reports obtained satisfactory communication. However, there were definite limitations due mainly to the fact that the selectivity of the tuning system was insufficient to prevent interference. A few years later Professor Pupin devised a method of obtaining selectivity by means of electrical tuning. This was the origination of the electrical filter design which has made carrier current operation the suc-

cess it now is. The development of electrical filters continued and neared perfection with the work of Campbell who obtained a number of patents in 1917. Until the expiration of these patents the use of carrier current circuits by others than the owner or licencees was definitely restricted. However, with their expiration in 1934 the situation has greatly improved and both carrier telephone and telegraph operation is now an assured practicability.

The theory of carrier current telephony was developed and presented about 1891 by Hutin and Leblanc (see Patent No. 596017). While the theory was correct the practical difficulties could not be overcome at that time due to the lack of suitable sources of alternating current and methods of controlling them; the matter of separating the signals by means of filters was not yet fully comprehended. In 1911 General Squires obtained patents and demonstrated a carrier telephone system between New York and Baltimore. This demonstration was probably one of the first successfully conducted to show the possibility of carrier current operation.

The limitations which early inventors had to contend with were practically eliminated with the advent of the vacuum tubes which provided means of generating the alternating current, modulating it so as to transmit the voice or telegraph signals and converting the carrier energy back to the voice or telegraph signal at the receiving end. This is known as **demodulation.** Owing to the patent situation however the development between 1911 and 1934 was

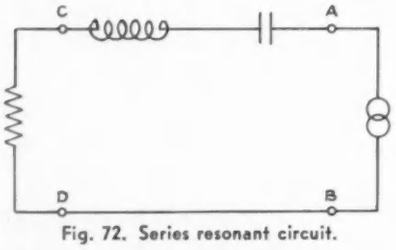


Fig. 72. Series resonant circuit.

greatly restricted in the independent field. Since that time numerous patents have expired and the development is again continuing.

Let us now return to our illustration of the electric light and switch. We know from our study of Chapter IX (Fig. 52) how to separate AC and DC currents by means of coil and condenser combinations. Now it is also possible by means of inductance and condenser networks to separate groups of frequencies. Assuming for example that this can be done (we will discuss the method later) suppose we had two generators such as used in power plants one generating a frequency of 60 cycles which is commonly used, the other generating a frequency of 120 cycles. By means of suitable inductance and condenser combinations we could connect both these generators to a line without any interference between them. In other words the load on the 60 cycle machine would not change when the 120 cycle unit was either on or off the line.

At the receiving end of the line we can also install a coil and condenser network (known as a **filter**) so that the 120 cycle voltage could be separated from the 60 cycle voltage. A relay connected to each receiving circuit would then respond as its associated generator were connected or disconnected from the line. Thus we have the basic principles of carrier current telegraph operation. This scheme can be carried on using different frequencies to obtain a great many telegraph circuits over one pair of wires. The only limitation is the selectivity of the filters and the transmission loss on the line over which the energy is sent.

● Let us now examine some of the simpler types of filters which enable us to select the frequency band we desire. Consider first, a circuit which will pass low frequencies but suppress the high ones. The basic circuit for such purpose is shown in Fig. 70 and is known as a **low pass** filter section. If we connect a generator to terminals AB and a resistance to CD we will find that at frequencies below a definite value the loss through the network is practically zero. However above a certain frequency known as the **cut off frequency** the loss increases rapidly. The principle of operation is quite obvious; at the low frequencies the choke coil offers little impedance to the flow of the alternating current (See Formula 12 Chapter III), likewise the shunting effect of the condenser across the circuit is small (Formula 15). However, as the frequency increases the impedance of the series path through the inductance goes up and the shunt impedance of the condenser goes down. The combination of the two effectively reduces the flow through the network. Now, if we reverse the coil and condenser combination as shown in Fig. 71 we have a filter which will pass the frequencies above a critical value and suppress the frequencies below. The principle is quite obvious as the reverse action obtains from that in the low pass filter of Fig. 70.

Most of you are familiar with so called resonant circuits which are a basic part of all radio sets. There are two types, one known as a series resonant circuit the other as the parallel resonant circuit. The **series resonant circuit** shown in Fig. 72 has the peculiar property of passing a band of frequencies with slight attenuation. At a critical frequency known as the resonant frequency the reactance of the coil and condenser in series is zero. This frequency is determined by the inductance of the coil and capacity of condenser and is expressed by the following equation.

$$Fr = \frac{1}{2\pi\sqrt{LC}} \qquad (37)$$

Where Fr is the resonant frequency L is the inductance of the coil in henries and C is the capacity of the condenser

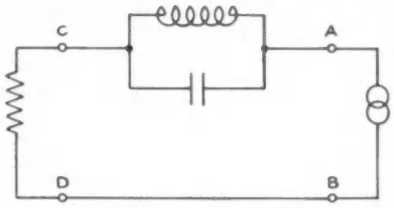


Fig. 73. Parallel resonant circuit.

in farads. If such a circuit is connected between a generator and a load as shown in Fig. 72 the loss through the coil and condenser will be very small at the resonant frequency. At other frequencies the loss will be comparatively large depending on the coil constants and other factors such as the load resistance and generator characteristics.

If we connect the coil and condenser in parallel forming a so-called **parallel resonant circuit** as shown in Fig. 73 we find that at the resonant frequency as obtained in Formula 37 the loss is exceedingly high and no current can flow from the generator to the load. At frequencies other than the resonant frequency the loss is comparatively small. Using the above basic combinations we can design filters that will pass any frequency or group of frequencies which we desire and suppress all others. The design of such filters is rather involved and we will not discuss the subject here. A very good discussion of filter design may be found in Albert's book on "Electrical Communication" (See bibliography Chapter XII).

Summarizing the types of filters which we used we have as follows:

(1) **Low pass filter—**
This filter will pass all frequencies below a critical value and suppress all frequencies above.

(2) **High pass filter—**
This filter will pass all frequencies above a critical value and suppress those below.

(3) **Band pass filter—**
This filter will pass a group of fre-

quencies extending from one value to another and eliminate all other frequencies outside that band.

(4) **Band elimination filter—**
This filter will eliminate all frequencies within a given band and pass all others on either side of the group.

● Let us now study a typical equipment combination which provides two DC telegraph circuits, a telephone circuit and a duplex carrier telegraph circuit; the schematic diagram for this is shown in Fig. 74. Only one terminal of the circuit is shown as both are identical. Referring to the figure, at the left you will observe three filters, two band pass and one low pass. The low pass filter passes all frequencies in the voice range and also the DC telegraph signals. You will note the composite set connected to the drop side of the low pass filter from which the voice frequency telephone and the two DC telegraph circuits extend. This arrangement is identical with that described in Chapter IX and illustrated in Fig. 52. As we discussed previously (Chapter II), intelligible voice transmission is obtained if a band from 200 to 2,000 cycles is transmitted. We, therefore, design the low pass filter so that all frequencies up to 2,000 cycles will transmitted with practically no loss. Frequencies above that value will be attenuated to a high degree, the exact amount necessary being determined by the circuit requirements. As a general rule the attenuation should be such that the loss at frequencies of 3,000 cycles and above exceeds about 40 db.

The carrier telegraph transmitter consists of two vacuum tubes one an oscillator (76-1) the other an amplifier (43-1). The circuit is so arranged that when the key is closed the oscillator does not function and no carrier signal is sent out onto the line. The oscillator circuit shown is comparatively simple and reliable. Its principle of operation is as follows: When the key is closed the voltage applied to the plate of the 76-1 tube is small due to the drop through the resistors R-4 and R-5. When the key is opened the voltage rises on the plate of the 76-1 tube and a current surge flows through the CL-26 transformer. This current surge is transmitted through condenser C-4 and resistance R-6 to the resonant circuit consisting of inductance L-1 and condenser C-5. This sets up oscillations in this circuit which when impressed on the grid of the 76 tube further increases the surge current of the CL-26 transformer. The circulation of current tends to build up the oscillations to a definite value determined by the tube constants. The oscillating voltage across terminals 3-4 of the CL-26 transformer is carried to the grid of the 43-1 tube through the potentiometer control (R-7); the energy is amplified in the 43-1 tube and passes out onto the line through the band pass filter. The frequency of oscillation is predetermined on the basis of the circuit design. As a general rule it is desirable to keep the carrier frequency as low as possible without interfering with the voice telephone circuit. Frequencies in use range from about 4,500 cycles up to 18,000 cycles as previously mentioned.

● At the receiving end the signal passes through the band pass filter and is amplified by means of the 76-2 and 43-2 tubes. The degree of amplification is controlled by means of the potentiometer, R-13. The amplified signal passes to the 76-3 tube where it is rectified and converted to d-c voltage which is impressed on the 43-3 tube. The 43-3 tube is so biased by means of the potentiometer R-11 that the desired current through the sounder is obtained when no carrier signal is incoming. This is generally 40 to 60 mils depending on the type of sounder

(Please turn to page 44)

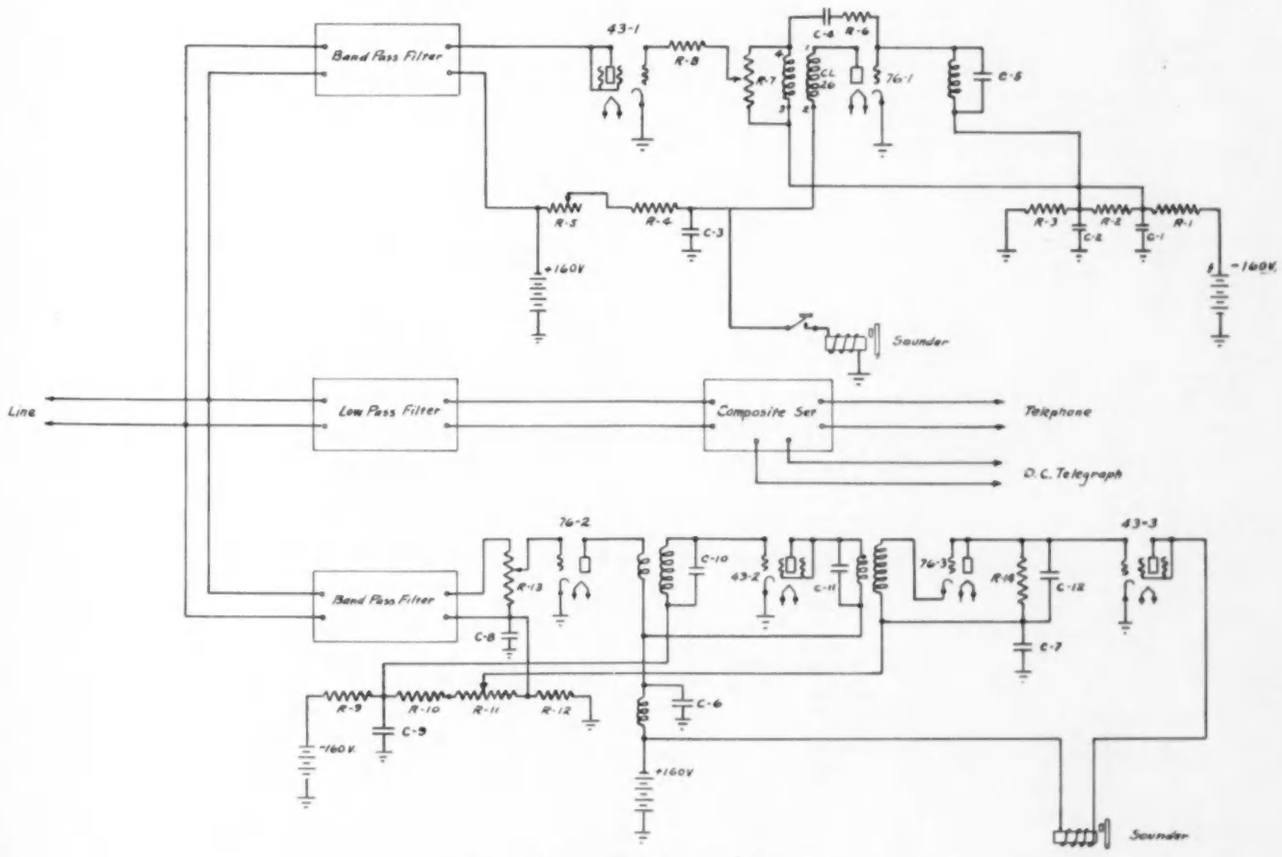


Fig. 74. Duplex carrier telegraph circuit.

By C. K. BROWN

P.B.X. Switchboard Maintenance

The proper battery and its equivalent usage in switchboards is the subject of the ninth article, prepared especially for Telephone Engineer.

PART IX

OCCASIONALLY the regular battery supply to a P. B. X. switchboard fails, thereby necessitating setting up an emergency battery supply. If a battery of dry cells are selected for this purpose, it should be borne in mind that the value of the current flowing in each telephone station circuit varies in accordance with the number of simultaneous station connections established at the switchboard, and if the variation of current flow is large, the satisfactory operation of the circuits will be unreliable.

Suppose for example, a battery of 12 standard No. 6 type dry cells having a voltage of $12 \times 1.5 = 18$ volts and about 53 ohms internal resistance are available for emergency battery current supply to a P. B. X., would it be suitable for furnishing current for 10 telephones simultaneously connected, each circuit having a resistance of 340 ohms?

● The value of the current flowing in each circuit would be

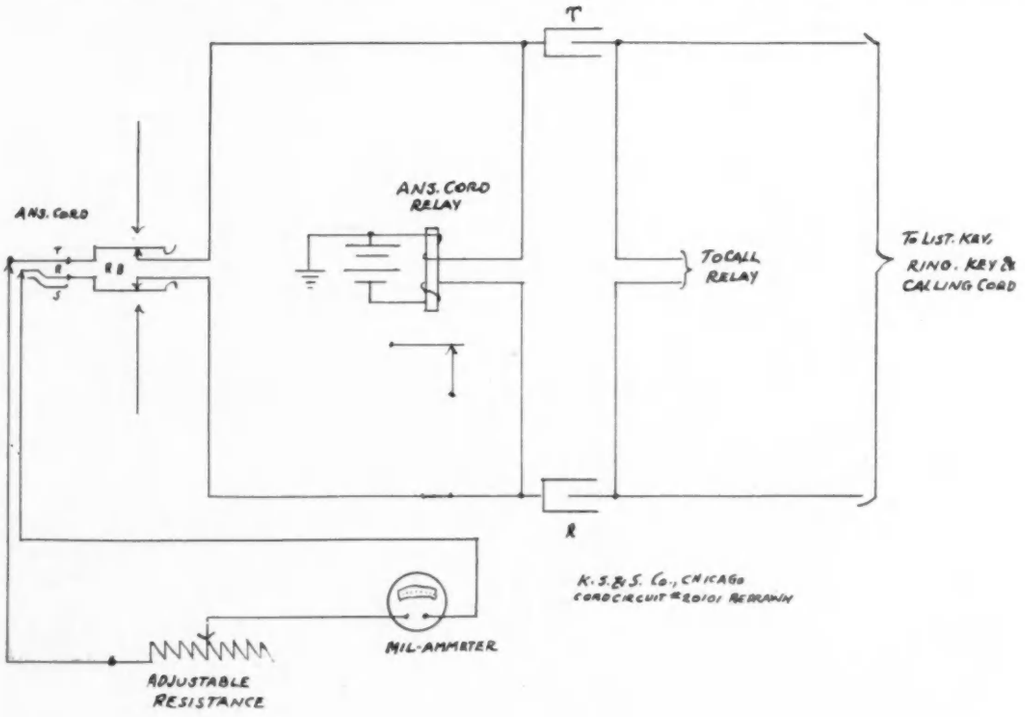
$$\frac{18}{1/10 \times 53 + \frac{340}{10}} = 0.0207 \text{ Amperes or } 20.7 \text{ Milli-Amperes}$$

The value of the current required to satisfactorily operate one station connection is $\frac{18}{53+340} = 0.045$ amperes, consequently dry cells will not be entirely suitable for supplying current for long periods of time where the number of established station connections are many because the current flowing in the circuits will vary from 0.0207 to 0.045 amperes, depending on the number of simultaneous station connections at the switchboard.

If instead of dry cells a portable storage battery is available for emergency service the variation in the value of the current flowing will not be as great.

● Suppose a portable storage battery having a voltage of 18 volts and 0.0018 ohms internal resistance is available for emergency service, what will the variation in current flow be in accordance with the station connections as stated above?

The value of the current in each circuit equals $\frac{18}{1/10 \times 0.0018 + \frac{340}{10}} = 0.0529$ amperes. The current when only one connection is established at the switchboard equals $\frac{18}{0.0018+340} = 0.053$ amperes. That is, the maximum difference or variation in this case is 0.0530 minus 0.0529 or 0.0001 amperes, and in conse-



Application of current flow method of adjusting relays.

quence thereof, the storage battery would be more suitable for emergency service use than a battery of dry cells due to the latter's high internal resistance.

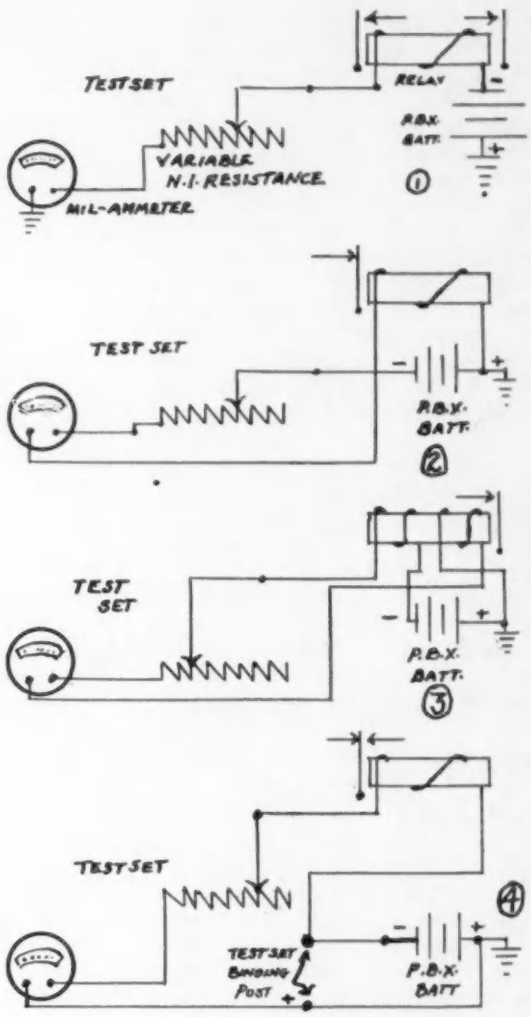
Miscellaneous problems: A certain group of P. B. X. switchboard extension station line relays consume 7.776 watts from an 18 volt storage battery supply. (1) What current does the relays consume? (2) What current does each relay take? (3) What is the joint resistance (J. R.) of the group? (4) How many relays in the group? (Note: each relay has a resistance of 500 ohms.)

Solution: (1). I=W/E or 7.77 6/18 =0.432 amperes. (2) I=E/R or 18/500 =0.036. (3) J. R.=E/I or 18/0.432= 41.7 ohms. (4) N=I/i in which "N" equals the number of relays in the group, "I" the total amount of current required by the group, and "i" the value of the current consumed by one relay. Therefore N=I/i or 0.432/0.036=12 the number of line relays in the group. From this the joint resistance may again be obtained as follows: J. R.=R/N or 500/12=41.7 ohms as given above.

● In the maintenance of P.B.X. switchboards clearing of faults which develop in the relay equipment is of great importance. P.B.X. relay ailments are somewhat similar to those of the human body, insofar as treatment is concerned, that is, they require careful diagnosis followed by the application of the prescribed remedy, which usually is that recommended by the manufacturer of the switchboard or the maintenance practices issued by the telephone company.

One outstanding feature regarding the maintenance of P.B.X. relays is that they should conform to the mechanical and electrical requirements as set up by the manufacturer. Such conditions are usually arranged in the form of a chart like that of the Kellog Switchboard and Supply Company shown in figure 1, and is explained as follows: (1) Under the heading "Relay No." is given the number or letter (as the case may be) of a relay according to its position in the corresponding P. B. X. switchboard circuit. (2) "Code No." This gives the maker's identifying number of a relay for the purpose of replacement on order from the telephone company. (3) "Coil Res." Here is shown the ohmic resistance of each relay. (5) "Mechanical Requirements." Under this heading is given the "Spring Tension." That is, the relay contact spring pressure or force exerted between the springs when they make contact with each other in order to insure a reliable electrical circuit through the contact points, and is measured in grams. The relay "Armature Travel" is shown here and, is the gap or distance between the relay electromagnet core pole piece and the armature measured in thousandths of an inch at the nearest point where the armature is resting against its back stop screw or adjusting nut, as the case may be, by the insertion of a flat type feeler gauge.

● In connection with the mechanical requirements of relays consideration should be given to such additional items as "spring contact separation," that is, the clearance between the contacts of two springs on the relay whose points are normally open, or any two springs contact points which are opened when the relay operates. Also "contact follow", measured by the distance the relay armature moves after the contact point on a stationary spring has just been engaged by the contact of a movable spring. (5) "Direct current flow in amperes." This



1. Method of connecting test set to adjust the current in relay with one end of its winding normally connected to negative battery.

2. Method of connecting test set to adjust the current in a relay with one end of its winding normally connected to positive battery.

3. Method of connecting test set to adjust the current in relay with two ends of its windings onrmally connected to the positive and negative terminals of the battery.

4. Method of connecting test set to adjust the current in relay which receives its operating current by the closing of the contacts of some other relay. In this case the battery is connected directly to the test set binding post to make the test.

Principles of making current flow tests of relays.

RELAY No.	CODE No.	COIL RES.	MECHANICAL REQUIREMENTS		DIRECT CURRENT FLOW IN AMPERES									REMARKS
					TEST						READJUST			
			SPRING TENSION	ARM. TRAVEL	TERM.	HOLD	AFTER SOAK	OPERATE	NON OPERATE	RELEASE	OPERATE	NON OPERATE	RELEASE	
1	2060	800Ω	15-G	.020				.0165			.015			24 VOLTS
2	2061	500Ω						.014	.005		.012	.006		24 "
3	546	200Ω 2000Ω	10-G	.010				.0045		.0004	.004		.0005	24 OR 48 VOLTS
4	2007	1000Ω		.020	189			.014	.005		.013	.006		24 OR 48 "

NOTES: .0165 AMPERES = 16.5 MILLIAMPERES
.0004 " = .4 of one MILLIAMPERE
15G: FIFTEEN GRAMS MEASURED BY MEANS OF A STEEL SPRING MOVING OVER A CALIBRATED SCALE
.020 = TWENTY THOUSANDTHS OF AN INCH MEASURED WITH A FEELER GAUGE

SAMPLE ELEC. & MECH. CHART AS ARRANGED BY K.S. & E. Co., CHICAGO

heading is subdivided into several minor divisions as (a) "Term", which refers to the end of a relay where the electromagnet windings terminate, (b) "Hold", this means that after a relay has been previously operated the value of the operating current can be reduced suddenly from the operate to the hold value and the relay armature will not move from the operated position sufficiently to open spring contacts which are closed, or close contacts which have opened. (c) "After soak", means that a much larger current than the test value is first allowed to pass through the relay winding, (d) "Operate" this means that when the specified operating current as given in the chart is applied to the relay winding, the armature shall move to and remain in it's operated position, (e) "Non-operate", denotes that when the non-operate current is applied to the relay the armature shall not move from the unoperated position. (f) "Release", means that when the testing current is reduced to the release value, the relay armature shall move from the operated position sufficiently to reliably open all contacts previously closed, and close all contacts previously opened.

To obtain the standard adjustments of P. B. X. relays on the direct current flow basis as recommended by the manufacturer, a set of special non-inductive (N. I.) resistances having fixed values are required, or a specially constructed type of test set is employed, in which a mill-ammeter (reading in thousandths of an ampere), and variable N. I. resistances are connected in series with the relay. The fixed resistances or the variable resistances are so arranged in the test circuit that the required "Operate", "Non-operate", "Hold", or "Release" testing current values are obtained.

● When the milli-ammeter needle indicates the specified current flowing through the relay winding the required adjustment is made either by means of the armature adjusting nut, or by tensioning the movable springs, as the case may be, to satisfactorily respond to the adjusting current. However, care should be taken not to alter the armature travel requirements.

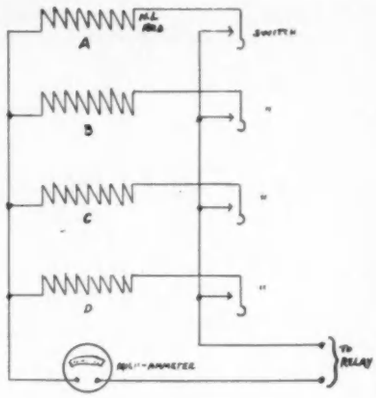
In setting up the current flow testing arrangements the following statement should be kept constantly in mind. With two electrical devices connected together in series, their combined resistance effect is of course, greater than either alone. With two devices connected in parallel their resistance is less than either alone. The best order of procedure, where there are many terminals to a piece of equipment, is to start with a given marked terminal and test it with every other terminal in turn to find out

A=operate current value

B=non operate current value

C=hold current value

D=release current value



Relay current flow test set arranged to test all values as given in requirements chart.

if the terminal being tested in connected through to more than one other terminal as is often the case. This point when overlooked naturally leads to erroneous results.

P. B. X. switchboard relays should be inspected for (1) Contact springs out of alignment, (2) Contact points burned. Burned points, unless too badly burned should be burnished with an approved type of burnishing tool. (3) Dirty contacts. A few grains of dirt, a bit of oil, or other foreign substance, settling between the contact points, may by the addition of the foreign substance increase the total resistance of the circuit to such an extent as to prevent the proper operation of the circuit. (4) Loose springs, these should be tightened at the assembly. (5) Contact spring follow. (6) Armature travel, (7) Relay loose on mounting. (8) That all parts, especially moveable parts are free from corrosive spots or rust. (9) No crosses between relay and mounting plate. (10) All parts free of dust. (11) Armature moves freely.

(12) Electromagnet pole face surface free from roughness or burrs. (13) Insulated parts of relay in good condition. (14) All connections soldered, also all mounting and other screws tightly in place.

● At times a spring or other movable parts of a relay will unexpectedly break without apparent cause. This sudden

(Please turn to page 37)

A Tribute

The last to leave, the first to return. Eight words synonmous with the telephone industry. Reconstruction of the terrific havoc wrought by the charging waters of the Ohio River was started even before flood water subsided. Tales of heroism are many. The industry can be well proud of loyal associates in their deeds and assistance in this, the most destructive inundation the Ohio River Valley has ever known. Last month we carried pictures depicting the unusual conditions encountered and left by this catastrophe. This month we pause to congratulate a great industry even though reconstruction leaves them little time to accept. To telephone companies, large and small, the public is now applauding your efforts of assistance and will hardly forget the hardships you endured that your neighbors, subscribers, and friends might combat the raging waters, perhaps save their lives.

Although telephone service is not restored 100%, both Independent and Bell companies are working night and day to restore service to their former standard. In many cases it was necessary to elevate switchboards to escape rising water. Taxi service by rowboat for operators was common. Estimates of damages to telephone companies alone run well over ten million dollars. Replacing cables and wire will take time and much heavy expense. But loyalty to the tenets of the industry as shown by the telephone people of the Ohio River Valley will amply repay their efforts in the good will of the people they serve.

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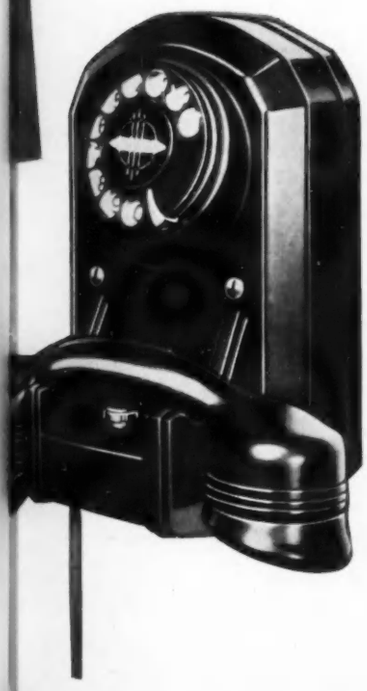

Now, telephone companies can offer trunk-connected, full automatic private exchange service which requires no attendance whatever — yet provides complete facilities for instant, accurate interior communication, improved service on trunk calls and many other operating advantages obtainable only in these new P-A-B-X units.

Why not investigate the scientific advances in private branch exchange service which these P-A-B-X's make possible and utilize them to expand your private exchange business? We will gladly co-operate with you in adapting P-A-B-X equipment to the particular requirements of any of your subscribers.

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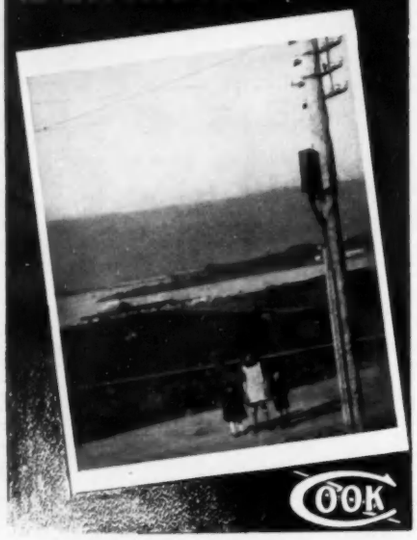

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Line and Desk

RAY BLAIN, Member A.I.E.E., Editor

Q. What is considered the most desirable means of connecting the winch line to the cable grip when pulling in a length of large underground cable?

A. A drop forged, hinged connecting link, shaped like a figure 8 is considered best for this purpose. This link can be opened so that the winch line may be connected to the cable grip without any special ties which may loosen under the heavy strain.

Q. Is the adjustment of relays on the current flow basis considered necessary and if so, what type of test set should be used?

A. Adjustment, then periodic check of relays on the current flow basis is undoubtedly the best means of maintaining relays. This method of relay maintenance will eliminate trouble immediately which might otherwise exist on a relay for months before it could be located in service. The current flow test set consists essentially of a milammeter and some form of adjustable resistance in order that any desired current may be quickly obtained. Most test sets are also provided with switches and keys for connecting the milammeter in series and relays, signals and lamps for indicating the closing of contacts. Jacks or binding posts are also provided to facilitate the connection of relays under test and for convenient connection to battery and ground.

Q. An English friend has just informed me that there are no party lines in England and although I doubt this statement I have no information at hand to prove or disqualify the same.

A. It is our understanding the British Post Office have made a number of trial installations of party line service, but since the English public demand secret service, even on party lines, which is characteristic likewise of continental European practice, these trial installations, it is understood, have not met with success. Some of the trial installations have made use of party line lock-out equipment but have not been successful due to the cost of this equipment.

Q. What type of dry cell battery is considered most economical for use on a small switchboard to supply current for the operators transmitter?

A. Perhaps the large, heavy duty type would prove most economical for this purpose. One manufacturer guarantees that their battery of this type, when properly installed and maintained, will deliver a minimum of 6,000 hours of "Peak" transmission at a cost of only one cent per each nine talking hours. This would cover a period of over two years in the average exchange. The voltage range of 3.75 to 3.3 is also maintained. This particular type battery is shipped dry and activated for service by merely filling with ordinary drinking water.

Q. What is meant by the "Wire Center" or "Center of Cable Distribution" in a telephone exchange?

A. Ordinarily this means the point from which the exchange area can be covered with the minimum amount of cable. This is not always near the geographic center but depends upon how and where the greater number of stations are located.

Q. Are the so called Solderless connectors considered satisfactory for use in a common battery telephone exchange?

A. Numerous improvements have been made in these connectors during the past few years and we now consider them entirely satisfactory for telephone work providing they are properly installed. There is no doubt but that in many cases they make a much better connection out on the line than when an attempt is made to solder.

Q. Is is considered desirable to place lead cable in back of the plaster on a wall when a building is being constructed?

A. We are of the opinion that a lead telephone cable should never be placed that it cannot be pulled out in case of trouble. Iron conduit with proper outlet boxes may be placed under plaster for telephone cable in a new building. With this arrangement a cable may be easily and quickly replaced in event of trouble.

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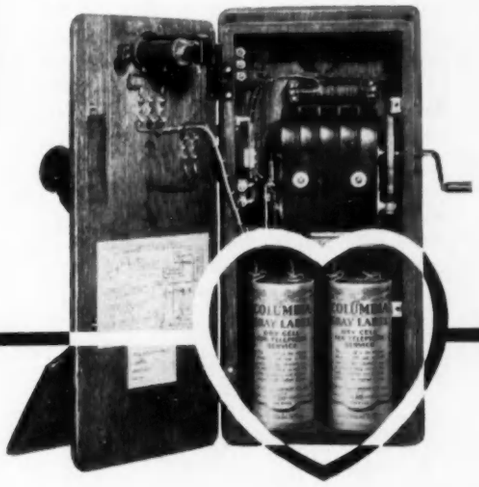
POSITIVE TERMINAL IN CENTER



Magneto telephone transmission can be no better than the batteries which give it its power. Unless the finest quality batteries are used, the telephone is not capable of doing its best work. Protect *your* transmission efficiency standards by using the finest telephone batteries made—"Columbia" "Gray Label" or the "Eveready" Long Life Telephone Dry Cells. They last longer and—*they sustain their voltage.*

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MODERNIZATION PROGRAM

of

PUBLIC TELEPHONE CORPORATION

GREENSBURG, INDIANA

by

WILLIAM J. SCHEIDLER

Vice-President and General Manager

● Greensburg, Indiana, is famous throughout the country as the "city with the feather in its cap" because of the tree which grows on the roof of its courthouse tower. How the "tree on the tower" exists with its roots gaining nourishment from the crevices in the roof has been of interest to scientific observers for more than half a century. The tree is a variety of large-toothed aspen about twelve feet high and is in healthy condition. Several smaller trees which have sprung up around its base have been cut away. Many visitors are attracted to Greensburg every year to see this phenomenon of nature.

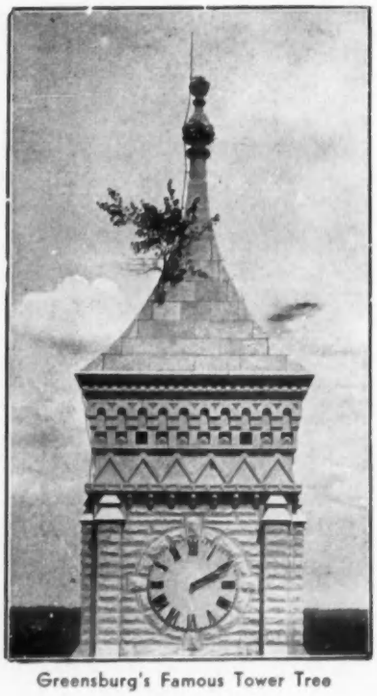
Greensburg is representative of the best type of small American city of 6,000 population, located in the midst of a rich agricultural district in the southeastern part of the state about midway between Cincinnati and Indianapolis.

● The reciprocal advantages and responsibilities which exist between a county seat of this size and the surrounding countryside are especially well illustrated in the relationship between Greensburg and the rural areas of Decatur County. Greensburg is centrally located and enjoys the advantages of being the trading center for this area. In return it fulfills its obligations by acting as the judiciary, educational and amusement center as well as the news, transportation and communication center for the entire county.

Communication facilities in Greensburg and Decatur County are provided by the Public Telephone Corporation. In addition to the main exchange at Greensburg there are exchanges at Clarksburg, Newpoint, and Westport. These supply telephone service to the rural areas of the county.

Recognition is given to the mutual interdependence which exists between Greensburg and the surrounding countryside by providing communication service on a county-wide basis. This county-wide service permits a subscriber to any one of the four exchanges to make unlimited local calls to subscribers of each of the other three exchanges without toll charge. This policy has been fundamental with the Public Telephone Corporation and its predecessors. It is felt that this is responsible for the kindly attitude of the subscribers toward the company since its beginning.

● The general history of the Public Telephone Corporation while paralleling that of many other telephone companies has certain unique characteristics. In the year 1900 the citizens of Greensburg and the surrounding territory united together and formed the Decatur County Independent Telephone Company. It was exceptional in that it was purely a mutual company and was said to be the largest of its kind in the country. The company grew and eventually acquired an automanual switchboard. This is one of the few cases on record of the purchase of a machine switching telephone system by a mutual company.



Greensburg's Famous Tower Tree

During the years that followed the company's operations were characterized by an extremely high subscriber saturation. This was obtained by building many long rural lines extending from twelve to fifteen miles into the surrounding countryside. These long lines were of course heavily loaded with subscribers. The subscriber saturation on the party lines in Greensburg proper was also exceptionally high during this period.

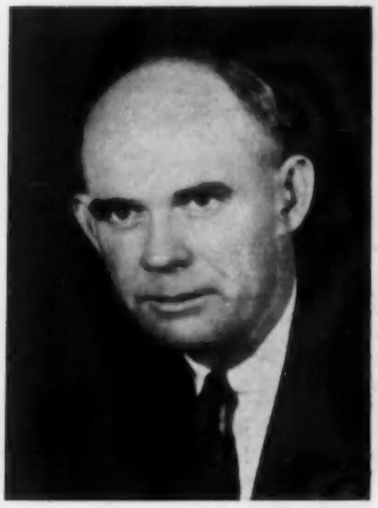
The gradual change of the Decatur County Independent Telephone Company from a mutual form of organization to a more centralized type of corporate structure took place slowly over a long period of years. However, it was a change which was inevitable in order to ensure a permanent plant in first class condition that would be capable of rendering the type of service the community required.

● In 1935 a further reorganization of the company's corporate structure occurred and the Decatur County Independent Telephone Company became the Public Telephone Corporation.

Mr. P. E. Goodrich of Winchester, well known Indiana telephone operating

Francis W. Dunn

Pierre E. Goodrich



John B. Goodrich

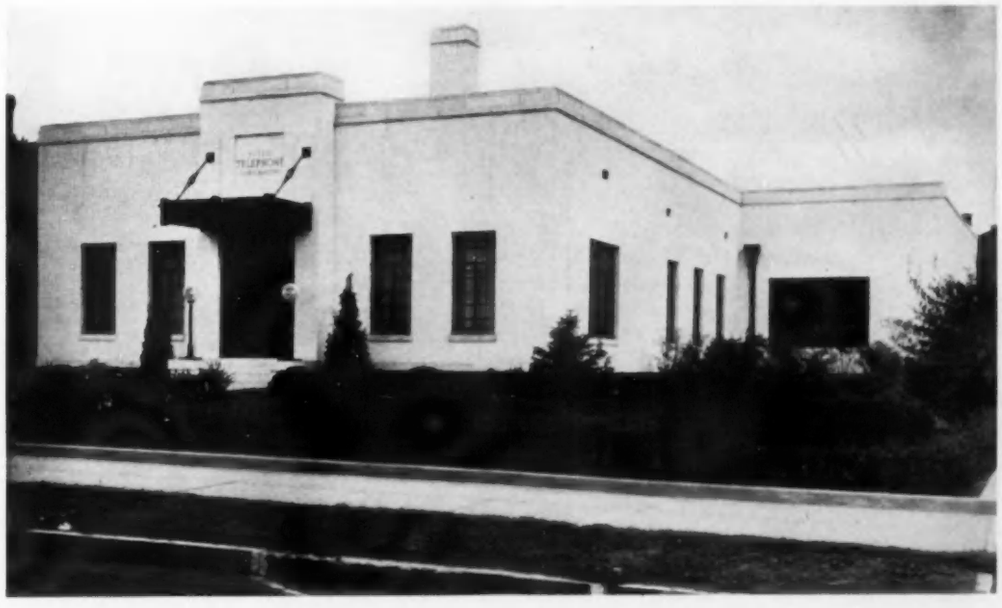
company executive, is the president of the Public Telephone Corporation. W. J. Scheidler of Greensburg, the vice-president and general manager, and Francis W. Dunn of Indianapolis, the secretary-treasurer of the company. These officers together with Mr. John B. Goodrich of Winchester constitute the executive committee.

This group has interests in other Indiana telephone exchanges and in telephone properties in several other states.

Consequent to the reorganization an extensive study of the existing telephone facilities was conducted with the result that a program of improvement was inaugurated involving the expenditure of considerable money. The initial step in the program was the rehabilitation of the entire outside plant. All rural pole lines were rebuilt, the old original subscribers' line wire was replaced with No. 12 B. B. iron, the toll and free service trunks between exchanges were replaced with No. 104 copper and the Greensburg plant in town was made all cable with 90% of the distribution system in underground conduit.

● The directorate next gave much consideration to the replacement of the old automanual central office equipment in the Greensburg office. A study of plants of comparable size to Greensburg and the industry in general was made, and it was evident that the trend was strongly toward dial automatic. To make sure of their findings, it was decided to equip one of the smaller exchanges as a trial installation and to correlate the results obtained elsewhere with those under actual local conditions.

A further study was made of the different types of dial automatic, and it was decided to install the all-relay type in the New Point exchange of the company. This exchange was located near enough to Greensburg to permit observations in the operation of the equipment and the reaction of the subscribers to this type of service and at the same time fit into a full automatic county-wide system. The observation of this installation and the results obtained from its operation for a period of two years proved very satisfactory, and 800 lines of the all-relay type was authorized for Greensburg.



The Public Telephone Corporation's Building at Greensburg

The housing of the new central office equipment presented new problems to the management since the housing arrangements required for dial automatic central office equipment are quite different from those required by other types of central office equipment.

● At New Point the Public Telephone Corporation was fortunate in being able to secure an abandoned jail building from the city officials. Due to the unusually substantial construction of this building, very few alterations were required in order to convert it into a suitable unattended dial automatic exchange building.

At Greensburg the company was able to purchase a lot very convenient to the main ducts of the underground cable system and only one-half block from the public square. A new, modern telephone building was constructed with garage and storeroom adjoining. The building is most attractive in appearance and designed for maximum efficiency. Ample provision has been made to accommodate the initial and the ultimate equipment facilities without slighting the space requirements for the commercial staff and the toll and special service switchboards.

The telephone building is a dignified structure located in the heart of the town in close proximity to the city's other principal buildings such as the banks, the post office, the Public Library and the buildings comprising the municipal group occupying the square.

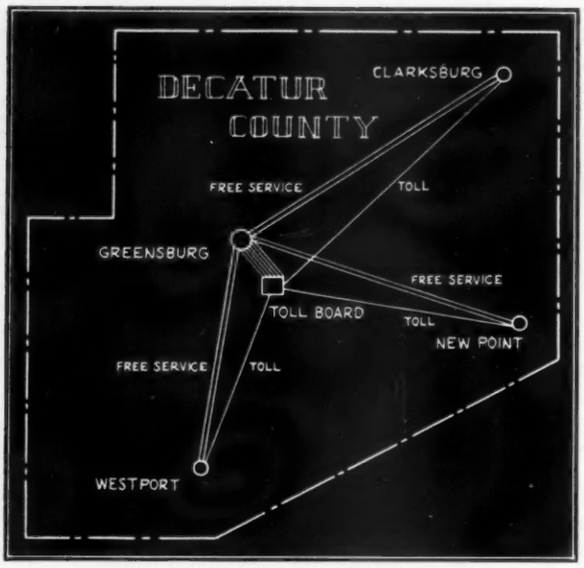
● The exterior is glazed white stucco patterned in Ashlar effect, with a coping of Indiana limestoneat the top. The steps and walk leading up to the building are also made of Indiana limestone blocks.

The commercial office and the Manager's office occupy the front part of the building. The central office equipment room and the toll board occupy the central part of the building. A spacious garage and repair shop is quartered in the rear of the building.

The public long distance telephone booth is much larger and more commodious than the average. A comfortable chair, and a table with a handset telephone is provided instead of the usual cramped quarters.

● In order to convey an impression of modernity the interior treatment of the building is of advanced style. Extensive use is made of the new plastic materials for the floors and walls. The lighting fixtures are of the indirect type and reflect the latest ideas in interior lighting. Modernistic office furniture is provided throughout the building.

The central office equipment has been housed in a specially built fireproof equipment room. This room has fire proof walls extending from the basement up through the roof in a parapet. In addition the room is provided with automatic fire doors. With these construction features, even though the rest of the building should catch fire and burn, the central office equipment could continue to operate without interruption. All wires including the light, power and telephone cables are brought into the building through underground conduits.



Decatur County Toll Network

● The new telephone building and the new automatic service were dedicated at a banquet held a few days prior to the cut-over. Approximately 200 guests were present including the full membership of Greensburg's two most active service organizations, the Kiwanians and the Rotarians, and many telephone engineers and executives from other Indiana operating companies.

The guests were addressed by Mr. J. P. Goodrich, former governor of Indiana, and Mr. P. E. Goodrich, president of the Public Telephone Corporation, in behalf of the corporation. Mayor John W. Shoemaker of Greensburg responded in behalf of the people of Greensburg.

Mr. F. R. McBerty, of Galion, Ohio, president of The North Electric Manufacturing Company, was the main speaker of the evening. His subject was, "The Progress of the Telephone Art," and in his discussion he sketched the development in telephone systems especially as related to automatic systems, with which he has been intimately connected for more than fifty years.

Following the dedication banquet the visitors availed themselves of the opportunity to inspect the new telephone building and the new dial automatic equipment.

● The Greensburg exchange was cut-over to dial automatic service at 12:45 A.M. on the morning of September 6, 1936. So minutely had the engineering details been planned that only 9 seconds were required to cut the entire 800 line exchange over to dial automatic operation. The change was made without any interruption in service. The toll connections were cut-over to the new toll board at the same time the local lines were cut-over.

That the cut-over was a matter of keen public interest was evidenced by the fact that a large number of people had stayed up long past midnight in order to be among the first to try out the new system. Throughout the day following the cut-over the traffic load on the switchboard was about three times that of a normal day.

The new dial automatic equipment installed at Greensburg is of unusual interest from the engineering standpoint because it is the first exchange of this size ever to be made on the All-Relay basis.

This equipment employs line finders, first selectors, second selectors, and connectors of the All-Relay type. All selections are performed by simple motion relays. Provision has been made to allow easy expansion of the equipment up to a total of 9,000 lines should it ever be required.

● The exchange power plant is located in the basement occupying the same quarters as the cable vault. It consists of a motor generator and a battery arranged on the float charge principle. The maximum output of the motor generator is about 50 amperes and carries the exchange load except for unusual peak loads and periods when the power is off.

The main exchange battery is a 240 ampere hour capacity battery and has sufficient reserve capacity to carry the exchange for about 24 hours or to allow 13,000 calls to pass in the event of complete failure of the commercial current.

Five frequency selective ringing is employed. This enables the company to

continue its traditional policy of providing the highest quality of service to the rural subscribers and town subscribers alike.

Due to the size of the exchange the method of *floating* the converter battery from the main exchange battery was found impractical. A somewhat larger converter battery with plenty of reserve capacity to take care of the peaks without a heavy drop in the primary voltage is used with a specially designed self-regulating battery charger to maintain this battery in a fully charged condition at all times. This tends to hold the frequency and the ringing voltage stable.

● Direct dial service from Greensburg to the subscribers in the outlying exchanges is provided. Greensburg subscribers dial the number of the required exchange and then the number of the desired subscriber. Two free service trunks and one toll trunk are available to each of the outlying exchanges. The trunks connecting Greensburg and its outlying exchanges are all of the AC dialling type. The signalling current for actuating these trunks is supplied by a 66 cycle converter.

It is planned to concentrate the toll and information services for the entire county at the Greensburg office. At the present time the Westport office is still operated on the manual basis. The new automatic switchboard for this office is now in production and will be cut-over at an early date.

● A total of 23 toll lines terminate on the toll board at Greensburg in addition to the free service trunks between the four Decatur County exchanges.

The network as a whole consisting of the four exchanges of Greensburg, New Point, Clarksburg, and Westport has a total of about 2,000 stations. It is estimated that about 5,000,000 calls a year are made over the system.

Death of Mrs. MacKinnon

Mrs. Cecil Leland MacKinnon, 57, widow of the late president of the United States Independent Telephone Association, died at the Leland home in Eldorado, Kansas, the morning of February 22, after a five month illness. The telephone industry mourns the loss of the gracious lady that endeared herself to the many acquaintances of her late husband. Her thoughtfulness and endearing charm provide a wonderful heritage to the three children surviving; Cyrus Leland, Frederick Benjamin Jr., and Cecilia MacKinnon; all attending school at this time. Other survivors are Cyrus Leland of Des Moines, a brother; and Miss Flora Leland of Eldorado, Kansas, a sister.

Omaha, Nebr.

Telephone Engineer
Chicago, Illinois.

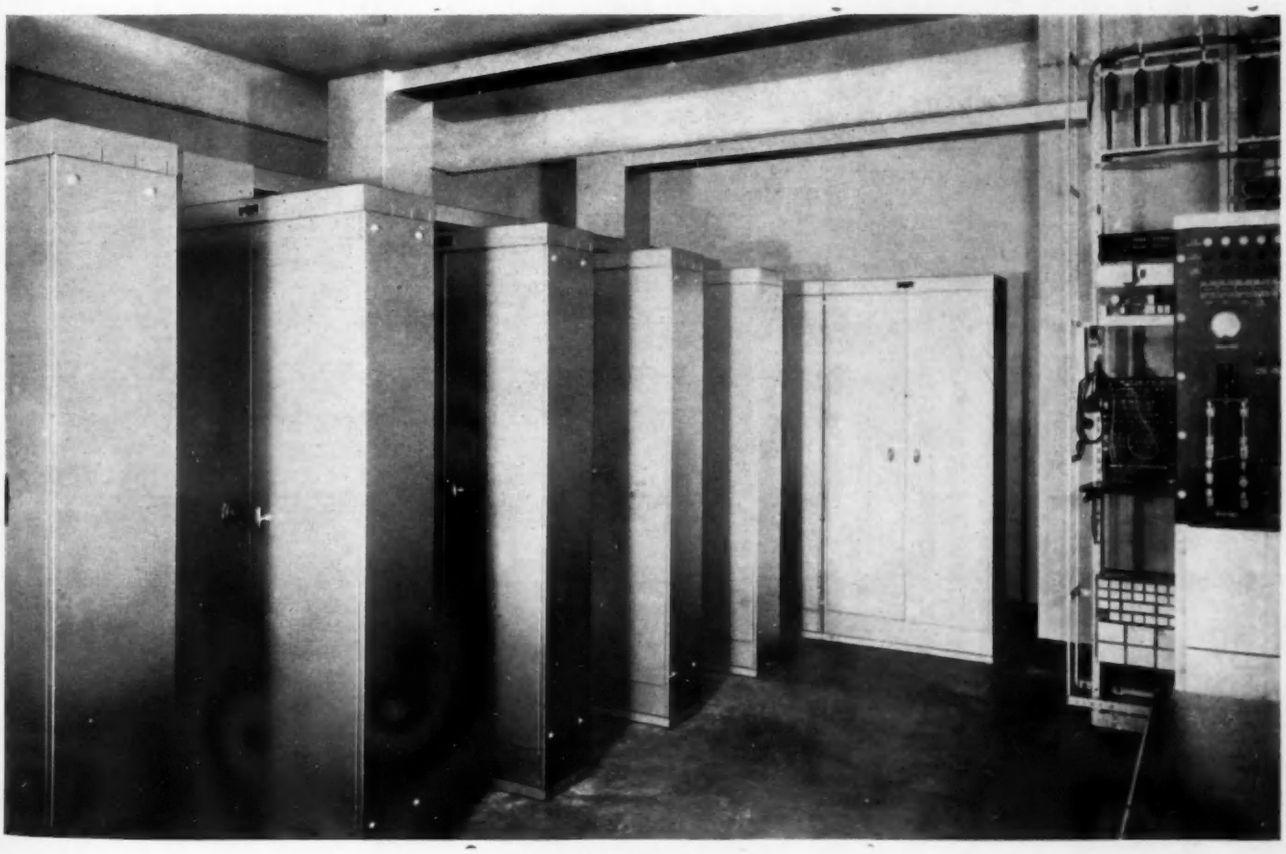
Dear Mr. Smith:

I had the pleasure today of spending a few minutes looking over the Buyer's Guide number sent to the Signal Officer Ft. Riley. I wish to compliment you on your fine job for this issue is certainly fine. I am certainly pleased with the fine appearance of the articles which carry my name. The pictures made fine cuts.

Here is something peculiar, though true nevertheless which happened today. An Officer here asked me if I knew the address of the Benjamin company. I stated that I knew it was in Chicago but I did not know the address. One of the clerks picked up his buyers' guide and looked up the address which was in Des Plaines, Illinois. He wrote right away for a catalog from them and very likely will purchase some lighting equipment. So you see that your Buyers' Guide started working right away.

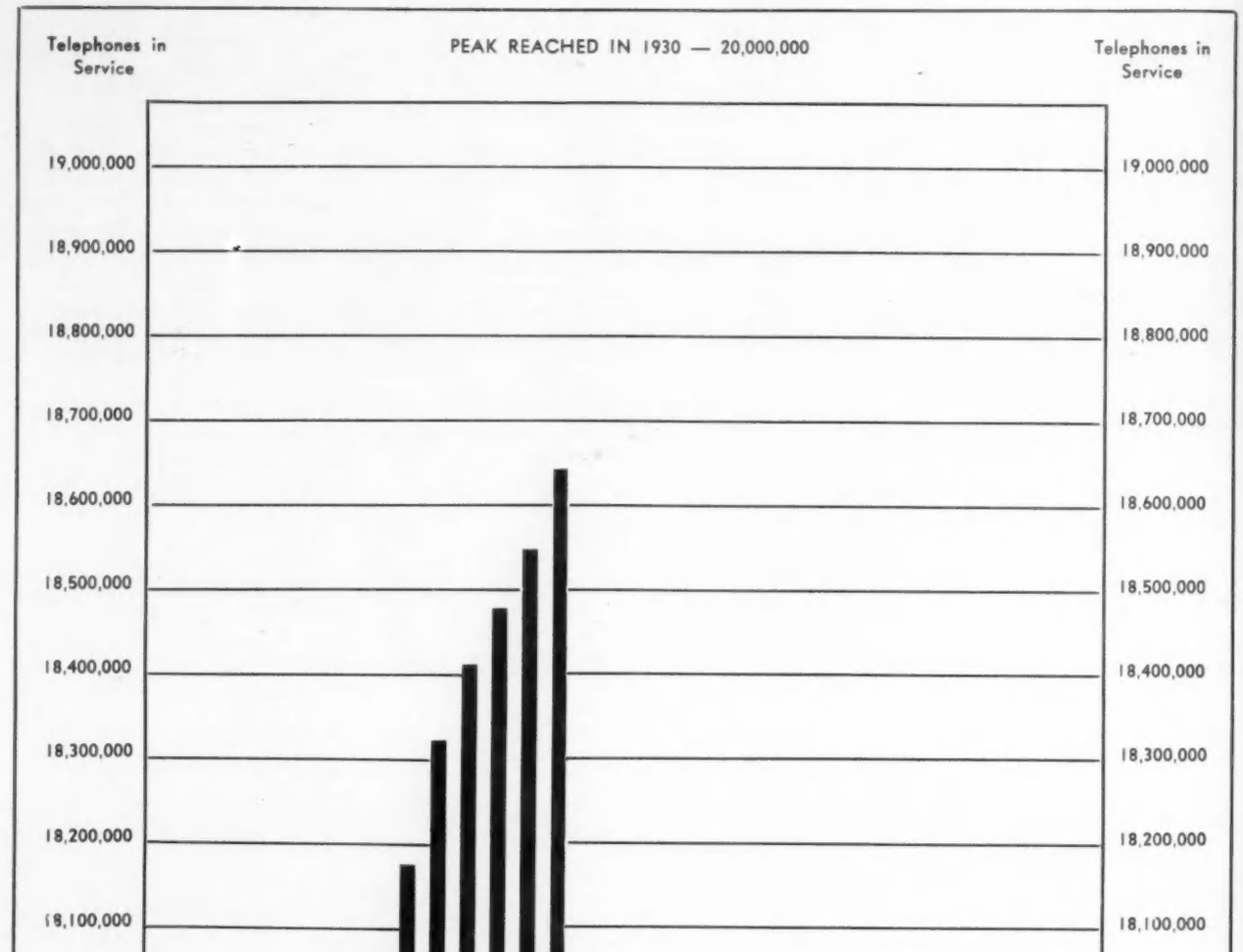
Sincerely yours,

(Signed) RAY BLAIN.

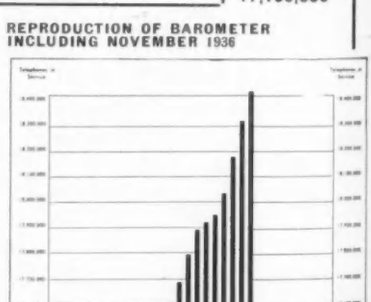


A View of the Equipment Room

Monthly Telephone Station Barometer



REPRODUCTION OF BAROMETER INCLUDING NOVEMBER 1936



E. R. Stonaker
Victim of Pneumonia

Edwin R. Stonaker, 50, advisory engineer Rochester Telephone Company and for many years with the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., died January 17 in Tucson, Arizona. Only in the Southwest since December and his death after a two day attack of flu and pneumonia was a distinct shock to many friends. Burial services were held at Grace Church, Newark, N. J., his birthplace.

Soon after the turn of the century Mr. Stonaker began his services to the telephone industry, first as a traffic student with the New York Telephone Company, rapidly rising to assistant traffic manager in New York City the following year. From this promotion he stepped to the managership of one of the local exchanges. Serving the Northern New York Telephone Corp. in various capacities in following years he made his mark as an engineer for his many ideas on operating and management methods.

His connection with the Rochester Telephone Corp. started in 1924 as consulting engineer, and served that company later in his career after spending several years with the Stromberg-Carlson Telephone Manufacturing Company in a consulting capacity. At the time of his death, Mr. Stonaker was serving the first mentioned.

His friends were many and the industry suffers a distinct loss with his passing. Besides his widow and daughter Janice, both of Rochester, his survivors are his mother Mrs. E. H. Stonaker, of Short Hills, N. J., two brothers and two sisters.

Complete Telephone in One Unit

No. 90CB Handset

Moulded of black durez

Booster anti-side-tone induction coil

Transmission is perfect

Always in service

Modern in design

Two Leich Handset Telephones that we are Receiving Daily Orders for

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MAGNETO HANDSET

can be used with present bell box or furnished with bell box (at small additional cost). Constructed of the best materials. Standard equipment includes anti-side-tone induction coil, stand and handset black durez finish.

Transmission more nearly perfect than any magneto telephone manufactured.

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LEICH ELECTRIC CO.
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DESIGNERS — ENGINEERS — MANUFACTURERS

New Northern White Cedar pole stocks seasoning under clean sanitary conditions.

A Short History of Northern White Cedar

By DON C. BELL

Replacements coupled by demands of Rural Electrification makes this timely article on poles one of real interest to those in charge of construction. The author, Don C. Bell, is well known as an authority, having many years of experience in the pole business.

THE northern white cedar pole is intimately associated with the history and development of the telephone industry throughout the east, middle west and south from the early days down to the present time. Through a great many years of use it has made an enviable record for dependability and long service life. It is recognized as being naturally one of the most durable of all pole woods suitable for communication lines.

Although for many years a variety of local trade names have been used throughout its natural range, it is generally and widely known under the name of northern white cedar. In various parts of the east it has gone under the name of "New Brunswick Cedar," "Maine Cedar," "Michigan White Cedar," and "Ontario Cedar," all of which are names that have been applied to the same tree which is known as *Thuya occidentalis*. The western red cedar of the Pacific Northwest is its only close relative in North America.

● Although it grows naturally in some of the same territory in which southern white cedar occurs it is a distinct and different tree and should not be confused with this species. Southern white cedar has been used for poles rather extensively in the east but it has not equalled the service life of northern white cedar. In the woods it is generally associated with moist lowlands and swamps where the growth is slow but uniform. This has produced the characteristic fine-grained wood so familiar to the many producers and users of cedar poles.

As a tree northern white cedar is about average in height but is not classed with the large timbers. It has produced in general few poles over 60 feet in length. The greater number of poles were and still are in the shorter lengths and for this reason are admirably adapted for use in communication lines.

● It was already used in large quantities many years ago. As long as 22 years ago purchases in one year amounted to 1,742,000 of these poles of which 1,029,000 were used in communication lines. It has also had extensive use for high tension power transmission, and very generally for secondary lines of lower voltage and for rural distribution.

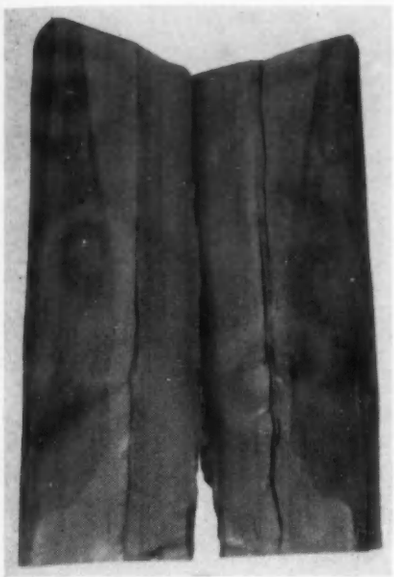
The wood of northern white cedar normally is light in weight, low in moisture content, has a high stiffness factor, and shrinks little in drying. It seasons rapidly with a minimum amount of checking. On account of the softness of the wood it produces a pole that is easy and safe to climb.

It has a greater taper factor than any of the other pole timbers, and in comparison with other pole woods this brings the center of gravity far down in the pole so that together with other factors, as butt treatment, pole lines built of this timber are not top heavy, have very pronounced stability and rarely incur any expense for realignment.

● Northern white cedar was one of the first woods to be studied and standardized for wood pole use by the American Standards Association. Based on test of full sized poles the fiber-strength value was set at 3600 lbs. per sq. in.

The significant dimension of a pole when designing a line is the groundline circumference in its relation to the line load. This was the basic factor in developing the A. S. A. tables of measurements for wood poles. Poles under these measurements regardless of species, with the same length and same top circumference have each a standard, but different, ground line circumference that makes them approximately equal in strength. Thus a northern white cedar 35 foot Class 6 pole is equivalent in strength to the same length and class pole of either chesnut, creosoted southern pine, western red cedar or douglas fir.

This Northern White Cedar power line was built in 1886. Many changes in load and alterations have been made. The above photo was made in 1932 after 46 years of dependable service.



This section of Northern White Cedar pole was split through a check. The irregular shaded areas show both sides of the check. The wood was sound. The pole stood in the line for 45 years. The check was there when the pole was set.

Although northern white cedar has a lower modulus of rupture than either of the other pole woods it has, on account of its average taper, a ground-line cross-sectional area sufficiently larger to offset this difference. What it lacks in fiber strength it makes up in extra wood so that it can match in strength any present day wood pole of the same length and class.

● Probably the most outstanding natural property of the wood of northern white cedar is the native and natural durability of its heartwood The sap-wood which is extremely thin, although it is in every respect as strong as the heartwood, does not have this same natural resistance to decay. Because of the small amount of sapwood at the ground line, poles of this wood are sometimes used without butt treatment. This practice may be satisfactory for temporary use but is not recommended where careful engineering design is worked into a line. The sapwood takes preservative treatment readily and all present day use of them should include thorough treatment of the sapwood of the butts of the poles.

Some of the earliest lines built of northern white cedar are still in service. Records of long and dependable service can be found in all parts of the country where the poles have been used. Photograph number 2 shows a northern white cedar pole line that at the time the photograph was taken was still in good condition after forty-six years of continuous service.

Many of the early trolley lines that extend into the country from various centers were built of northern white cedar. One such record shows that a line built in 1898 was dismantled after thirty-four years. During this time the poles received no maintenance until after they had been in service for thirty years. When these poles were removed the wood above ground was in remarkably good condition. Even at the ground line where there was more or less decay the average breaking load of sixteen representative poles was approximately one thousand pounds. The test load was applied at the top and was measured by a standard dynamometer. The poles were tested in their original setting.

● Northern white cedar poles are standing on the streets of Chicago at the present time that were set in 1896. As shown by recent groundline inspection they are expected to continue to give good service at least until 1948, at which time

This section of the pole top was in the sound condition shown after 36 years of line service. Bolt holes and saw cuts are as clear and free of decay as when newly cut.

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TELEPHONE PRUNERS
Important users say, "We have had excellent reports from our men in the field." "Is easier on the operator; performs the work faster than any other pruner head we have ever used." "We have not experienced any breakage whatsoever." "In constant use nine hours a day for the past three months—proves to be the best pruner head made." "All of our men are asking for this type and we will have to take the others off the field."
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No. 11 Pruner Head Length 10" Overall Wt. 1¼ lbs.
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Cable Splicers' TOOLS

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FURNACES
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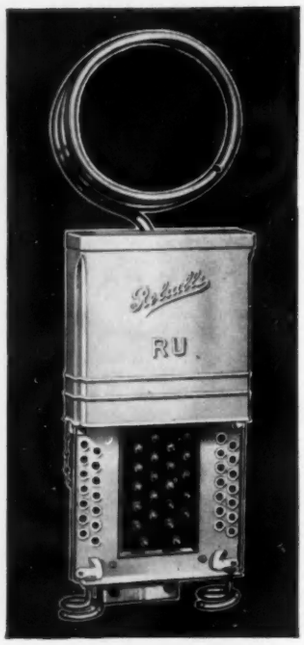
A DEPENDABLE
CABLE
TERMINAL



Reliable

Type RU unprotected terminals are easy to install, easy to work on and built to outlast the cable.

Upon request we will send a sample for your inspection without charge.

Reliable
ELECTRIC COMPANY
OVER 25 YEARS SERVICE TO THE UTILITIES
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they will have been in service fifty-two years. There are many other long life examples that might be mentioned. A great many of these old cedar lines were dismantled because of obsolesence and the full service life of the poles was never obtained. Many of them have been reused.

Adaptability of northern white cedar is an outstanding characteristic. Service changes, additional attachments, extra cross-arms or brackets can safely be put on at any time while the poles are in service. New bolt holes, new gains, or any other alterations can be made without endangering the service life of the poles.

Photograph number 3 shows a gain and a bolt hole after thirty-six years in the line. No evidence of any decay is present and the tool marks as well as the bolt holes are as clear cut as the day they were made.

● Northern white cedar poles develop seasoned checks just as any timber in the round does when it is seasoned. These seasoned checks are often times falsely accused of causing internal decay. They bear no known relation to the strength of the pole.

Photograph number 4 shows a section of a pole split open through a check. The shaded portion with the irregular line shows the two surfaces of a check that was in the pole when it was set in the line forty-five years before it was removed. The interior of the check shows a small amount of weathering and discoloration but is entirely free of decay.

Northern white cedar was a pioneer in wood pole use. Its merits have not depreciated. It measures up to present day pole requirements as well as it did to those of fifty years ago.

New Directory Company Formed

A corporation has been formed with Madison (Wis.) officers and stockholders to take over the publication of telephone directories, and to look after the sale of the advertising for those directories. The company is a Delaware corporation and simply filed a certificate of its incorporation under the laws of Delaware with the secretary of state of this state. The officers of the corporation are Frank C. Davies, president, E. M. Blakslee, vice president, E. M. Hiestand, secretary, and C. D. A'Aoust, treasurer. All give their offices as 122 West Washington st, Madison, the Wisconsin Power and Light bldg. It is expected that this will be the offices of the company. Frank C. Davies, E. M. Blakslee, and T. R. Hefty, president of the First National bank there, are Wisconsin men who are directors of the company.

Williamsport Strand
DEFIES CORROSION
thru its UNIFORM
NO-FLAKE COAT

Williamsport Strand is guarded by a PERMANENT galvanized wall . . . it wears longer . . . costs less by the year.
To obtain this tougher sheathing, each wire is handled with extreme precision . . . carefully processed by skilled workmen, SPECIALISTS in the science of galvanizing.
Every wire bears a strictly uniform coat, that positively resists cracking and flaking . . . thus giving consistently longer life . . . the proved economy . . . of Williamsport Strand.

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National Dist.: Joslyn Manufacturing & Supply Co.
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Switchboard Maintenance

(Continued from page 22)

breaking is said to be due to the metal becoming "crystallized". Scientists in their research work have discovered considerable about the nature of this crystallization of metals by examination under the lens of a miscroscope after specimens are bent back and forth countless times. Minute cracks, invisible to the naked eye, are seen working their way into a piece of metal. When these cracks have spread far enough the remaining uninjured portion of the metal is no longer able to carry the load and of course the whole piece gives way. Crystallization cracks in the metal of a P. B. X. Relay movable parts start very easily at rough surfaces, notches, or nicks.

Telephone plant men know how easily a wire can be broken by bending if the wire is first nicked with a pair of diagonal pliers. Therefore, it is good maintenance practice not to leave tool marks on relay parts which during normal operation tend to bend or twist.

It is possible to control the occurence of faults in P. B. X. switchboard equipment, and the best way to control them is by prevention through routine methods and practices.

● However, the location and clearing of faults in the equipment can only be correctly performed when the essential tools and repair parts as recommended by the manufacturer of the particular type of P. B. X. switchboard are provided and used.

Telephone Engineer,
Chicago, Illinois.

Dear Mr. Smith:

We are very well pleased with the appearance of your new issue of Buyer's Guide, and particularly well pleased with the appearance of our advertisement on page 3. In fact the whole publication is very good and all other advertisements stand out well.

With reference to the cartoon on page 35 and the page on Safety First, these are both very effective and answer the purpose for which they are intended. We believe that this number is outstanding and is valuable to the whole telephone industry.

Yours very truly,

Loren M. Berry,
For: L. M. Berry & Co.

Exide-Chloride Battery cut away to show its sturdy construction. Length of life and reliability far beyond average. This battery is especially adapted for all classes of telephone service.

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Speaks Louder Than Words

For example, our records show many cases where Exide Batteries have been submerged under 3 to 15 feet of flood water, yet continued to deliver the power that kept emergency circuits alive, long after all other forms of power supply had been cut off. Furthermore, after the floods, a little cleaning and a recharge was all that was required, in most instances, to put the batteries back into service.

It is performances of this kind which enables us to say: *"In emergencies, Exides will see you through—deliver the power needed—when needed most."* Their operation is not interfered with by either fluctuations or interruptions of the A. C. current.

There is an Exide Battery for every telephone job: common battery, emergency reserve, signalling, P.B.X.

THE ELECTRIC STORAGE BATTERY CO.
Philadelphia . . . *The World's Largest Manufacturers of Storage Batteries for Every Purpose*
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BATTERIES
FOR EVERY TELEPHONE USE

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. . . that's what every telephone engineer seeks . . . *more hours of service* . . . which means fewer replacements, lower service costs! And that's exactly what Ray-O-Vac telephone batteries offer!

For 3 decades Ray-O-Vac batteries have met and exceeded specifications and requirements on every recognized telephone and light intermittent test, and surpass all government standards. For lower service costs, specify Ray-O-Vac!

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Formerly FRENCH BATTERY COMPANY
MAIN OFFICES AND PLANT
MADISON, WISCONSIN
Additional Factories at Clinton, Massachusetts and Lancaster, Ohio

Here's Shorter "Shortest Telephone Line"

We have brought to light a successful challenger to the "nation's shortest telephone connection" featured on the front cover of "Telephone Engineer" for February in connection with the luxury "Mainliners" of the United Air Lines.

The new giant flagships of the American Airlines also have telephone connections between the stewardess and second pilot, but because the stewardess' station is forward, the telephone line is correspondingly shorter—actually a little over ten feet.

The illustration shows Stewardess Electa J. Harper using the Automatic Electric Monophone on one of the new flagships.

One-Man 'Phone System

Herman, Nebr., has a one-man telephone company that has just completed its thirtieth year in the business. The "company" is John H. Johnson, owner and manager, and it is rated one of the most successful small exchanges in eastern Nebraska.

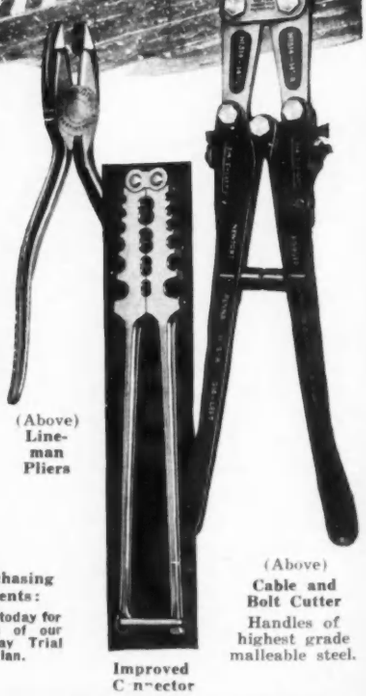
LASHED by the blizzard—half blinded by sleet—lines down—havoc everywhere! That's when linemen know the value of tools that bear the name "Vacuum Grip." Stormy weather friends! Tools built with the precision and strength that insure swift action and dependability in emergencies.

PROFESSIONAL LINEMAN PLIERS — Amazing strength and cutting power. Easy-riding joint opens at the touch of the little finger. Perfectly aligned hand-edged cutters. Insulation strippers. Outlasts 4 and 5 ordinary pliers. No. 58-R—length 8½" (popular size) —$3.25.

LINEMAN'S IMPROVED CONNECTOR — Locks TIGHT on sleeve or wire, making a perfect joint with little effort. Matched pin-and-hole (exclusive) compels true alignment. For all standard popular size copper sleeves and bare wire. Has oval hole for guy strand .437 x .624. No. 12—12"—$4.50.

LINEMAN'S CABLE AND BOLT CUTTER—Does the work of cutters from 1-4 to 1-3 longer. Blades (interchangeable as a unit) of toughest electric furnace tool steel, hand-edged and kept in alignment by a special improved type bearing plate. No. 314—14"—Cutting capacity 5-16". Complete with side-cut blades $4.00; center-cut $4.25; diagonal-cut $4.40. No. 318—18"—Cutting capacity ⅜". Complete with side-cut blades $5.00; center-cut $5.25; diagonal-cut $5.50. No. 324—24"—Cutting capacity ½". Complete with side-cut blades $6.50; center-cut $6.75; diagonal cut $7.00. No. 336—36"—Cutting Capacity ¾". Complete with side-cut or center-cut blades $9.00.

FORGED STEEL PRODUCTS CO., NEWPORT, PA.



(Above) Lineman Pliers

(Above) Cable and Bolt Cutter
Handles of highest grade malleable steel.

Improved Connector

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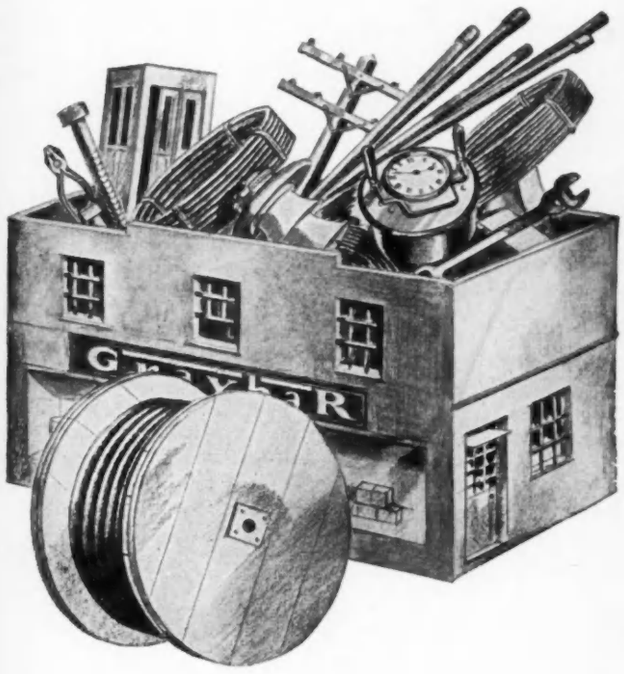

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...and 60,000 other items

WHERE dependability counts—only the highest quality electrical products will do. One such quality product is Western Electric Lead Covered Cable—a cable whose dependability is insured by the most exacting of manufacturing standards.

But that's not all. Out of its roster of 60,000 electrical items, Graybar is prepared to meet *any* need of a telephone industry. And behind *every* Graybar item stands the Graybar reputation for quality that goes back 68 years.

GraybaR

OFFICES IN 80 PRINCIPAL CITIES
EXECUTIVE OFFICES: GRAYBAR BUILDING, NEW YORK, N. Y.

Your ANCHORING PROBLEMS SIMPLIFIED

When you use MASTERGRIP ANCHORS

"L2 TYPE"

Engineers everywhere are saving money by more modern and efficient methods of guying. They are matching the anchor to the load, saving the difference. They don't depend on tamped earth to hold the strain. Mastergrip Anchors place their entire blade area against undisturbed soil. Once this anchor is set in place, it's there to stay. It does not depend on loose earth tamped on top of it for any part of its holding power. Check the small hole size. That explains Mastergrip's great efficiency.

This greater holding power, smaller size and lighter weight is due to simple design and malleable iron construction. There is no riveting in Mastergrip construction. No welding, pressing, joining or trigger-work. The anchor consists simply of the body and two, three or four broad, tough blades.

Each Mastergrip blade works independently. If one blade, in opening, strikes a rock or other obstruction, the other blades will continue to open to the full extent.

EFFICIENT ANCHORAGE SAVES YOU MONEY

- Mastergrip is more economical because at no greater initial cost, it is less expensive to install.
- Mastergrip saves you money because it is easier to install. You don't have to dig a big hole—just a 2, 3 or 4 inch pilot hole. The sharp point makes it easy. In fact, the smaller sizes may be readily driven without any pilot hole.
- Mastergrip has power to hold. Study it for a moment. See how the entire blade holds against undisturbed soil. This accounts for its amazing holding power. Each blade is larger than the head itself.
- Mastergrip is light in weight—compact—self-expanding. Every operation is easier.

QUICKER AND EASIER TO INSTALL
One of Mastergrip's money saving features

In setting the three inch hole six feet deep for a Mastergrip installation, your man will remove only 509 cubic inches of dirt. Contrast this with the 3,618 cubic inches he would have to dig out of an eight inch hole six feet deep for other anchors holding the same strain! Mastergrip Anchors are easier to handle because they are as much as 30% lighter in weight than the ordinary anchor and smaller in size. Yet they are capable of doing a bigger job with greater ease. Save labor, time and money! Use Mastergrip Anchors!

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63 E. Lake St., CHICAGO 114 N. 7th St., ST. LOUIS

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Klein Climbers are made in standard and "light weight" styles, each the finest for its particular use.

Going up a sixty foot stick — working on wires high above the ground — a slip might be fatal — a spur that cut out a genuine hazard. The lineman throws his weight on his climbers with calm confidence — he knows they are Kleins. Klein Climbers, like all Klein tools, are the standard of quality in the electrical and public utility field.

DISTRIBUTED THROUGH JOBBERS

Foreign Distributor: International Standard Electric Corp., New York

The four pamphlets listed below will be sent without charge to anyone interested. Check the ones you want:

- ☐ Safety for the Pole Climber.
- ☐ Specifications on Linemen's Belts and Safety Straps.
- ☐ The Safety Factor on Linemen's Leather Goods.
- ☐ Pocket Tool Guide.

Mathias KLEIN & Sons
Established 1857 — Chicago, Ill. U.S.A.
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A. T. & T. Nets $9.36 Share in 1936

For the first time since 1931 the American Telephone & Telegraph Company earned enough in 1936 to pay the regular $9 dividend without dipping into surplus. This was revealed in the annual reports just made public.

Drainage of surplus for dividend will not be necessary any longer as the income has steadily risen with 1936 showing a very healthy gain that is also reflected in the month station barometer carried elsewhere in this issue. This company, known as the premier utility and largest corporate enterprise maintained its regular dividend during the depression years. Net income totalled $175,826,414 or $9.36 a share on 18,685,093 outstanding shares at the year end. This compares with $6.74 a share earned in 1935.

Consolidated net income of the Bell system was $184,744,464 equal to $9.89 a share on parent company stock and comparing with $132,918,493 or $7.11 a share, adjusted basis, in 1935. System operating revenues rose to $994,852,132 from the 1935 adjusted total of $919,116,223, a gain of 8.2 per cent while operating expenses increased 2.7 per cent from $641,448,611 to $659,025,149.

Western Electric Company, telephone manufacturing subsidiary, earned a net income of $18,698,000 in 1936 against $2,620,279 in the preceding year as sales scored a 38.9 per cent gain, totaling $146,400,000 against $105,400,000.

"Bell system taxes," Walter S. Gifford, president, said in his report to stockholders, "continued to increase. The 1936 total of $116,800,000 was $22,300,000 greater than in 1935. Taxes were equal to $8.36 per telephone in service, $5.98 per share of common stock outstanding and $470 per employe."

The number of employes of the system rose to 294,362 as of December 31 last from 269,904 a year earlier, an increase of 24,458. This total includes employes of Western Electric Company and Bell Telephone Laboratories, Inc. Without those companies the employment total stood at 255,814 against 241,169, an increase of 14,,645.

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Crapo Galvanized Telephone Wire and Steel Strand can be spliced and served without injury to the galvanizing. The heavy, uniform, *pure zinc* coating, applied by the *Crapo* Patented Process, is so adherent and so ductile that it defies sharp bending and twisting. This insures corrosion-resisting joints, adds to the life of the wire and actually reduces maintenance costs . . . . Specify genuine *Crapo* Galvanized Steel Strand and Telephone Wire for all new and replacement work! They more than meet the most rigid specifications. . . . .

Indiana Steel & Wire Company
Muncie, - Indiana

Crapo Galvanized Steel Strand is first choice of leading utilities both for guying and for messenger cable. Photo from Peoples Telephone Co., Butler, Pennsylvania.

INDIANA STEEL & WIRE CO. MUNCIE IND.

Telephone Wire • • Steel Strand

WASHINGTON

(Continued from page 14)

successfully at the last Congress, will be given brief hearings by the House committee before any decision. It is expected the telephone industry will again present its position that it is essential for employees and connecting companies to have free or concession service in order for the proper operations of the telephone business. The bill would only affect interstate telephone service.

Chief Hurt In Flood Relief

George B. Quatman, president of the Lima (Ohio) Telephone & Telegraph Co., was recovering in a Cincinnati hospital from burns suffered while assisting in flood relief work in that city early in February.

Quatman shipped his 15-passenger motorboat to Cincinnati and for nearly a week assisted in evacuating refugees. His crew consisted of his son, Frank, and a telephone company employe, Cliff Lewis, both of Lima.

Quatman's face and arms were burned severely when spilled gasoline on the power boat ignited while the tank was being filled.

Brach Announces New Product

A radical departure from the customary methods of controlling telephone bell ringing circuits has been made available thru the introduction of a new product known as the Vincent Rare Gas Relay. This relay is intended to be used on either harmonic or coded ringing bells, and when used on harmonic bell circuits it replaces the mechanical relays now employed since the Vincent Relay possesses many features that make it superior to the mechanical device.

Where mechanical relays are used, these are generally bridged across the line, and on machine ringing the cut-off is dependent upon the central office relay picking up on the difference of resistance bridged across the circuit. Where Vincent Rare Gas Relays are used and mechanical relays omitted the adjustment of the tripping relay is no longer required to be within narrow limits. This definitely prevents premature tripping in either manual or dial offices.

From the above it is apparent that this relay simplifies the present methods, and should be relatively trouble free; and by providing better service, it should assist many telephone companies in offsetting demands for lower rates by improving the equipment.

If you are in the telephone business, Suttle can serve you to best advantage in some capacity or other. It will pay you to check Suttle Catalogs frequently to find out just where and how you will get the best deal from the Suttle Organization.

The Crystopac

This is Suttle's newest creation for magneto service. It incorporates the new "Chassis Mounting" features, enclosed gongs, with the high efficiency of the Leich handset. Furnished in six beautiful colors of crystallized finish. It's the safest investment you can make in subscriber satisfaction.

SUTTLE Salesman No. 43

Now On Its Way To You

By the time you receive this magazine the newest 1937 Suttle catalog will be in the mails on its way to you. It will bring to you a lot of new interesting ideas, besides the latest price changes to date. (There's a lot of them). If we missed you, tear out this corner of the ad and send it to us with your name and address. We'll fix you up.

SUTTLE EQUIPMENT CO.

LAWRENCEVILLE, ILLINOIS

Compression Tested

In addition to the "Bomb Test," samples of all Whitney Blake Telephone Wire are tested in a machine especially designed for checking the strength and density of rubber compound of Telephone Wire. The long life of Whitney Blake Telephone Wire is partly due to the use of this unique machine, which indicates the ability of the insulation to withstand the stresses and strains it will be subjected to during and after installation.

Telephone Wire

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J. W. Sproles Elected

J. W. Sproles was elected president of the Greenwood (S. C.) Telephone company to succeed the late George A. Barksdale at a recent meeting of the stockholders.

Mr. Sproles has been connected with the company since its organization 41 years ago and for many years has been general manager, a capacity in which he will continue to serve as well as that of president.

G. Roy Barksdale was elected first vice president and consulting engineer of the company. Other officers are C. Bruce Barksdale, secretary and treasurer, and W. T. Bailey, second vice president.

Brown Cord Fever

Fraternity friends rallied recently to the rescue of Don Richon, sophomore at Colgate University from Hempstead, L. I., who incurred a bill of $44.50 in telephoning his girl in Belgium. Members of Phi Gamma Delta Fraternity held a tag day to pay for the call. Tags were sold to students, townspeople and guests at Winter carnival house parties. It was called "Belgium Telephone Relief."

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The NEW and IMPROVED
DILLON TEMPEROMETER

AVAILABLE IN APRIL

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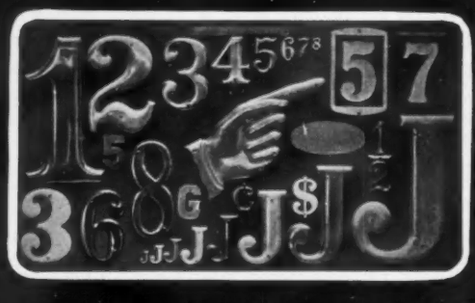
LETTERS and FIGURES
FOR EVERY PURPOSE



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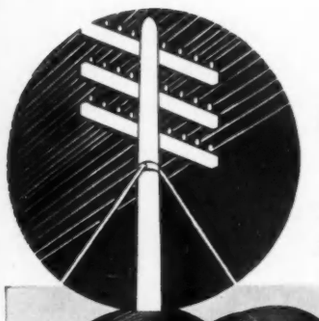
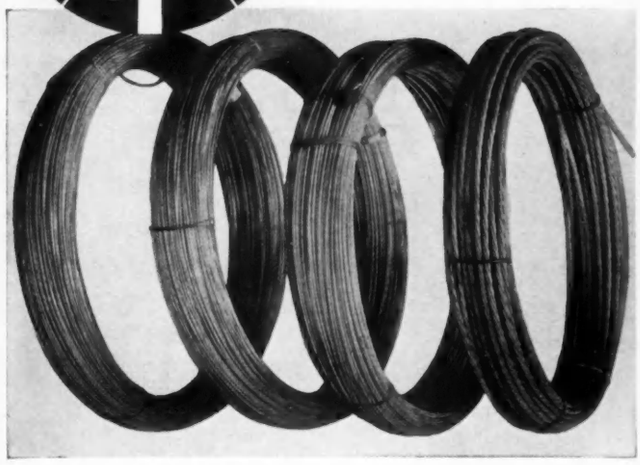
Preferred by the Leading Companies



Progress in America is typified by a network of communication lines. Progress in making wire and strand for these lines is heralded by the name USS Perfected.



USS Perfected Telephone, Telegraph Wires and Strand are galvanized only by the Hot Process. This method offers the utmost protection against corrosion.

TODAY, as millions of miles of wire carry the pulsing throb of the nation's business and social activity, the American Steel & Wire Company is proud of the part it has played in making modern communication systems dependable.

Over 100 years ago, American Steel & Wire Company pioneered in wire making. Today, its USS Perfected Telephone, Telegraph Wires and Strand are recognized as standard, the best in quality, material and workmanship. That is why these products are the outstanding preference of leading communication and transportation companies.

The modern hot process of galvanizing as developed by the American Steel & Wire Company and used on USS Perfected Telephone, Telegraph Wires and Strand offers the utmost protection against corrosion and assures long satisfactory service. Exhaustive tests have convinced us of the superiority of the Hot Galvanized process.

U·S·S PERFECTED

Telephone, Telegraph Wires & Strand

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For the convenience of readers of Telephone Engineer

Telephone Transmission Theory and Practice

(Continued from page 19)

or relay if used. When the rectified signal is impressed on the 43-3 tube it effectively biases the grid to the point where the plate current through the 43-3 tube and sounder is reduced to zero; this obviously opens the sounder.

There are innumerable combinations of design which may be had, some of them simpler than the scheme shown others more complicated. However, the essential features are all the same, i.e. a means to start and stop the carrier. signal on the transmitter side, and open or close a sounder with carrier impulses on the receiving side.

The circuit described above provides duplex operation. By connecting the carrier circuit to a relay combination comprising a telegraph half set as shown in Fig. 43 (Chapter VIII) it is possible to provide single line operation. In certain cases where only single line operation is desired the carrier telegraph system can be designed to operate in both directions on the same frequency. This has certain advantages and permits setting up way station circuits whereby an equivalent single line circuit such as shown in Fig. 39 may be obtained.

(To Be Continued)

BIBLIOGRAPHY

[1] Squire, G. O. "Multiplex Telephony and Telegraphy by Means of Electric Waves Guided By Wires." "Proc. A. I. E. pp. 857-905, May 1911.

Notice

The concluding chapters of "Value-of-the-service Factor in Utility Rate Making" will be carried in the April issue of Telephone Engineer.

Texas Surpasses Installation Record

In an interview with the Dallas (Tex.) News, A. B. Elias, St. Louis, president of the Southwestern Bell Telephone Company, reported that Texas now has more telephones in service than at any other time in its history. This statement was made late in February during an inspection of properties in Texas.

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W.E. 105 line, 15 pairs of cords	350.00
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Western Elec. No. 22C Shutter type line drops and jacks 5 per strip @	8.75
Western Elec. No. 2C Ball type 80 ohm line drops and jacks 5 per strip @	6.00
Kellogg No. 2696 4-bar 1000-1600 or 2500 ohm Bdg. compact type wall sets	8.00
Western Elec. No. 317 5-bar 1000-1600 or 2500 ohm Bdg. compact wall sets with 47 Gen. and external post line connections @	8.50
Kellogg No. 84 desk set with Kellogg Trans. & Rec. complete with New cabinet 3-bar 1000-1600 or 2500 ohm ringer inside connection signal set $9.50—4-bar $10.00—5-bar @	11.25
Western Elec. No. 20 desk set with W. E. Trans. & Rec. Complete with New cabinet No. 315 3-bar 1000-1600 or 2500 ohm ringer inside connection signal set @ $9.75—4-bar $10.50—5-bar	11.50
Kellogg New Grabaphones with New cabinet inside connection 3-bar 1000-1600 or 2500 ohm signal set @ $12.25—4-bar $12.75—5-bar @	14.00
Kellogg Grabaphone No. 115 Stand & No. 11 Grabaphone complete less signal set @	7.25
Western Elec. No. 21 W 1 M. F. Condensers @	.35
Monarch desk set complete with 3-bar 1000-1600 or 2500 ohm ringer inside connection signal set @	7.85

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New Wisconsin Association

The organization meeting of The Wisconsin Independent Telephone Association was held at the Loraine Hotel in Madison on March 3rd.

The directors elected were: Wm. F. Goetz, Mgr. Necedah Tel. Co., Necedah; E. B. Mikesell, Div'n Mgr. Mid-West States Tele. Co. of Wis., Fond du Lac; F. H. Runkel, Gen. Mgr. Commonwealth Tel. Co. Madison; W. F. Goodrich of La Crosse Tel. Corp., La Crosse; Wayne Newell, Pres. & Mgr. Farmers Mutual Tel. Co., Baraboo; R. E. Fenske, Prop. Home Telephone Co. Richland Center; Howard Teasdale, Sec'y Monroe Co. Tel. Co., Sparta; A. Bowen, Sec'y Bangor Telephone Co., Bangor; H. M. Smith, Sec'y Badger State T. & T. Co., Neillsville.

The officers elected were: President, Howard Teasdale, Sparta; Vice-Pres., R. E. Fenske, Richland Center; Sec'y & Treas., W. F. Goodrich, La Crosse.

The association was not formed by the consolidation of any other telephone organizations in Wisconsin but is to be new and separate for the benefit of those companies and individuals who wish to join an association that does not include any Bell interests.

"Going to Make a Speech?"

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Counsel in Consumer and Trade Relations; First President, Association of National Advertisers; Former Member of Council, United States Chamber of Commerce; First President, National Association of Steel Furniture Manufacturers; etc. etc.

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A

Aiken Anchor Co.....39
Albert Pick Hotels.....42
Albertson Electric Co.....—
American Steel & Wire Co.....43
Amer. Tel. & Tel. Co.....6-7
Automatic Electric Co.....23-24-25

B

Bartlett Mfg. Co.....—
Bashlin, W. M., Inc.....—
Berry, L. M.....44
Bowdle Accounting Systems.....44
Brach, L. S. Mfg. Co.....46
Buckeye Telephone Supply Co.....45

C

Calculagraph Co. 9
Carney & Co., B. J.....44
Chance Co., A. B.....—
Churchill Cabinet Co.....—
Coffing Hoist Co.....—
Communication Equipment Engineering Co. .....—
Cook Electric Co.....30

D

Davey Tree Expert Co.....—
Dillon Mfg. Co.....42

E

Electric Storage Battery Co., The...37
Everstick Anchor Co.....—

F

Forged Steel Products Co.....38

G

Gaylord Mfg. Co.....—
Gould Storage Battery Corp.....—
Graybar Electric Co.....39
Guardian Electric Mfg. Co.....—

H

Habirshaw Div., Phelps Dodge Copper Products Corp.....—
Harrison Hotel.....—
Herdrich & Boggs.....44
Holtzer-Cabot Electric Co.....—
Hubbard & Co.....—

I

Independent Cord Co.....—
Indiana Steel & Wire Co.....40

K

Kearney Corp., Jas. R.....—
Kellogg Switchboard & Supply Co....4-5
Klein, Mathias & Sons.....40

L

Larkin & Co., John C.....44
Leich Electric Mfg. Co.....33
Lenz Electric Mfg. Co. 10
Littelfuse Laboratories .....—
Loomis Advertising Co.....—
Lorain Products Corp.....10

N

National Carbon Co.....2-27
National Telephone Supply Co.....10
North Electric Mfg. Co.....48

O

Owens-Illinois Glass Co.....43

P

Phillips Electric Works, Ltd., Eugene F. .....—
Premax Sales Division.....42

R

Ray-O-Vac Co.....38
Rebuilt Electric Equip. Co.....45
Reliable Electric Co.....36
Russell, C. B.....44
Runzel Cord & Wire Co.....—

S

Seymour Smith & Sons, Inc.....35
Shallcross Mfg. Co.....—
Siemen Bros. & Co., Ltd.....—
Stewart Bros.....—
Stromberg-Carlson Tel. Mfg. Co...8-47
Sturgis Posture Chair Co.....46
Sundt Engineering Co.....—
Suttle Equipment Co.....41

T

Telkor, Inc.....43
Telephone Repair Shop.....45

U

Union Carbide & Carbon Co.....2-27
Unique Mfg. Co.....35

V

Valentine & Clark Corp.....44

W

Western Electric o.....11
Whitney Blake Co.....42
Williamsport Wire Rope Co.....36
Wodack Electric Tool Co.....—
Wopat, J. W.....44
Wray, J. G. & Co.....44

Y

Yale & Towne Mfg. Co.....—

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